Life Stress
AND
Essential Hypertension

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A STUDY OF CIRCULATORY ADJUSTMENTS IN MAN

BY

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PREFACE

Essential hypertension has proved to be one of the most elusive medical problems of our day. Although the underlying hemodynamic changes are fairly well understood, the mechanisms whereby the changes are brought about and the factors responsible for activating them are still obscure. In view of the oft heard implications that "wear and tear" and "stresses of modern civilization" have something to do with the process, the authors have set out to review the data linking circulatory adjustments to life experiences.

In this volume we have tried to pull together into a coherent statement the results of studies on cardiovascular function carried out over the past ten years in the laboratories of Cornell New York Hospital, including a few supplementary observations made in the Department of Medicine at the University of Oklahoma and the Oklahoma Medical Research Foundation. Those colleagues who participated in this work are listed below with their present addresses and academic connections.

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Had all of these collaborators, spread out as they are over the nation, shared in the authorship of this book, the job of producing it would have become so unwieldy as to be virtually impossible Nevertheless each one is in a sense responsible for part of it Although references are given in the text to original published work, we would nevertheless like to take this opportunity to thank them all for the experience of sharing this work and for allowing us to represent them in this communication

We also wish to thank our technical assistants Mrs Mary Ann K Angel, Miss Dorothy Dingfeld Mrs Barbara Graupner, Mrs Jane Marsh, Mrs Elizabeth Mills Mr Oliver Winter and Mr David Greenberg Thanks are also due Miss Helen Kolson for valuable help in preparing the manuscript, Miss Shirley Wells, who helped organize and edit the case reports and Miss Ruth H

Pinsky who helped greatly with all phases especially bibliography, tables proofs and index To all of these interested helpers we express cordial thanks

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CHAPTER I

SCOPE OF THE PROBLEM AND METHODS OF STUDY

THE blood vascular system is responsible for nourishing the cells of the body its vessels penetrate virtually every organ, provid intercommunications among certain organs and serve to integrate their activities Changes in structure and function of any of the bodily organs may be related fundamentally to changes in blood flow or in the contractile state or the permeability of vessels Pressure changes in an organ related to adjustments in hemodynamics may also be of importance as in the glomeruli or in the sinusoids of the liver or spleen When as in some diseases and bodily disorders structural changes implicate the vessels, vasculitis and perivascular inflammation may occur or there may be degenerative changes in the vessels themselves

The behavior of the heart and its tributary vascular channels is largely subject to control by autonomic nerves locally manufactured chemical vasomotor substances and by chemicals within the general circulation as well as by mechanical stimuli Some of these alterations in vascular behavior reflect themselves as changes in secretory function as in the stomach as excretory function as in the kidney and as changes in permeability of vessels They also may be manifest in the form of painful distention of vessels, as in migraine headache

Some forms of hydrocephalus glaucoma, and dermatitis owe their mechanisms primarily to alterations in vascular function Blood vascular alterations are also of leading importance in hepatic cirrhosis pneumonia and ulcerative colitis In fact inflammation itself is essentially a vasomotor adaptation The consequences of

the vasomotor adjustments depend on the locality in which the changes occur Thus, constriction of cranial arteries may induce neurological deficits of varying degree, and dilatation, headache Vascular engorgement in the turbinates, on the other hand, causes stuffy nose and may trap pathogenic organisms in the nasal and paranasal spaces, leading to infection Elsewhere the consequences of vasodilatation and vasoconstriction vary with the site In the skin vasoconstriction conserves body heat In the efferent arteriole of the glomerulus it increases the pressure of urine filtration In the liver, pressure changes resulting from vasomotor effects are manifest in the arteriovenous shunts of hepatic cirrhosis Even more widespread pressure changes in the venous system occur as part of the syndrome of congestive heart failure, or in the arterial system as arterial hypertension

It is an old story that changes in function of the heart or blood vessels accompany emotional reactions, such as anger or excitement In fact, wherever vasomotor adjustments have been studied, for example in the eye, the nose the skin, the stomach, the colon and in the general circulation, it has been shown that they are subject to influence by meaningful life situations If vasomotor changes are ultimately shown to be important in the production of vascular degeneration, it follows that threatening life situations may be an important factor in arterio and arteriosclerosis and the complications consequent thereto

Our aim in the present study was to investigate as many aspects of cardiovascular function as we could and to observe the circumstances under which each one was altered The component experiments in this program, as already acknowledged in the preface, have been carried out with several individual collaborators For the most part the detailed descriptions of these studies have been published elsewhere and are referred to at appropriate points in the text

METHODS

Two hundred and sixteen patients with various cardiovascular disturbances were collected and followed in a special clinic No attempt was made to select patients for any purpose whatsoever,

but in view of our known interest in personality adjustment in relationship to disease it was inevitable that a relatively large number of patients with obvious emotional problems gravitated to this clinic Others, however were gathered entirely at random and without reference to their life adjustments All of the patients were studied with respect to background and life experience, attitudes and aspirations These data were gathered from face to face interviews with the patient and other members of his family, dreams associations slips of the tongue, gestures and behavior One hundred and thirty five presumably healthy subjects served as controls for the various test procedures

In many instances a diary record was kept from day to day in which events attitudes and reactions were correlated with the occurrence of symptoms of cardiovascular disturbances When such observations indicated repeatedly the temporal coincidence between events provocative of significant personal conflict and measurable changes in cardiovascular function, one had presumptive evidence that the two might be related The validity of this suspicion was then tested in a short term experimental observation

The Stressful Interview

Recordings of the cardiovascular function in question were made during a control period of suitable length while the subject was relaxed and at ease At an appropriate moment the topic of suspected conflict was introduced for discussion When the reaction to this maneuver included a measurable cardiovascular change the evidence was considered to have been strengthened After several minutes the experimenter attempted to terminate the stress period by reassurance and efforts at diversion When the disturbance could thus be turned off it could be fairly concluded that the life situation and the cardiovascular response were indeed connected or that the topic discussed was a suitable prototype of the relevant conflict

It is significant that vascular changes could not be induced by a discussion of every topic to which an individual would presumably be sensitive It was possible in many instances however, to

acquire, after a brief conversation with the patient, a sufficient knowledge of the patient's life experience and the course of his disease to select for discussion a relevant topic that would call forth a measurable cardiovascular response

The means of measuring cardiac function included continuous electrocardiographic tracings This enabled one to record heart rate and rhythm as well as the shape of the electrical complexes

Radiographic measurements of heart size were made from time to time in all patients Tests of exercise tolerance were also made, using the pulse as an indicator and also the form of the electro cardiogram and ballistocardiogram

Estimations of the renal blood flow were made in normotensive and hypertensive subjects using the para aminohippurate and inulin clearance methods of Smith and his associates (1) Arterial pressure was estimated from frequent sphygmomanometric read ings in either arm under a variety of circumstances and following such test procedures as the immersion of the hand in cold water In one group of patients the contractile state of the small capil laries and venules of the skin of the forearm was estimated by the use of Di Palma's ring (2) In another group of patients, *in vitro* measurements of clotting time and blood viscosity were made using the siliconized tube method and the viscosimetric technic of T'ang and Wang, respectively (3) Appropriate periodic exam inations were made of the vessels of the retinae, of the palpable arteries in the extremities, the state of circulatory competence with reference to cyanosis and evidences of congestive failure increased venous pressure and changes in circulation time The heart sounds were frequently heard through the stethoscope, the urine was examined and periodic tests of renal function were made Lipoproteins were measured in a few instances

Many observations were made with the aid of the ballisto cardiograph This instrument was particularly suitable because of the ease and frequency with which recordings could be made during the course of an interview without disturbing the subject This convenient device does not allow for the measurement of cardiovascular dynamics with a high degree of precision but there is little doubt that ballistocardiographic tracings reflect hemody

namic changes brought about by adjustments in stroke volume and peripheral resistance Following exercise for example, or infusion with epinephrine or norepinephrine the changes in cardiac output calculated from the ballistocardiographic data were in the same direction as those determined in other laboratories by the use of the cardiac catheter and the Fick gasometric principle

In situations where there were rapid swings of cardiac output and peripheral resistance above and below the base line, the results from the two methods did not correspond well and the inferences as to direction of changes are hence less certain On the other hand, when adjustments were slower without quick changes from one direction to another reliable inferences concerning direction of change could be drawn In any case, the ballistocardiographic data are used as indicating direction of change without attaching quantitative significance to them The terms 'stroke volume 'cardiac output' and 'peripheral resistance' are therefore used in quotation marks

A short critical review of ballistocardiography, incorporating the results of standardizing procedures carried out with the instrument used will follow in Chapter VI

Summary

Circulatory responses in areas of the human body other than those traditionally considered to be cardiovascular have been included in the present study For detecting alterations in cardiovascular dynamics, only those methods which afforded a minimum of discomfort to the patient and the least possible disturbance of the experimental situation were used *Prominent* among experimentally applied stimuli has been the "stressful interview", in which topics of known threatening significance in the subject's life were introduced for discussion while the indicators of cardiovascular function were being recorded

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There are good biological precedents for postulating a bodily reaction "as if" or in anticipation of some circumstance Perhaps the most familiar is the acceleration of salivary and gastric secretion during the pleasurable contemplation of eating It was not surprising therefore, to find that when subjects were familiar with the experimental procedure, which included a period of exercise, they often developed the characteristic hemodynamic changes while they were lying on the ballistocardiographic table in anticipation of exercise or merely during a discussion of exercise Whether or not the ballistocardiogram gives an accurate indication of stroke volume or peripheral circulatory resistance, it certainly reflects changes in hemodynamics It is therefore significant that changes identical with those associated with exercise were observed during the mere discussion of muscular effort and perhaps more strikingly during stress without the conscious anticipation of exercise Similarly of course, brisk increases in salivary and gastric secretion have been described not only in anticipation of eating but during stress unconnected with alimentation (6) Following relatively mild exertion undertaken during periods of stress excessive and prolonged cardiovascular changes have been found to occur (61)

The exercise stimulus used in these studies was the "two-step test of Master, in which the subject ascends and descends two 9 inch steps for one and one half minutes the number of trips being adjusted to the age sex and weight of the subject (7) Most of the tests were done in the morning under basal conditions but a few were performed at other times of the day not less than two hours after the last meal Before beginning observations the subjects rested on a bed for approximately 20 minutes

Heart Rate and Cardiac Output

Studies of exercise tolerance" involving heart rate, electrocardiogram and ballistocardiographic pattern were carried out on 35 subjects and reported by *Duncan, Stevenson* and their colleagues (5 59) Of the group 8 were healthy, asymptomatic persons 11 had complaints of palpitation and fatigability with or without exertional dyspnea but no demonstrable heart disease

CHAPTER II

CIRCULATORY ADJUSTMENTS ASSOCIATED WITH MUSCULAR EFFORT

Muscular effort is a familiar stimulus to cardiovascular function On the basis of the predictability in degree and duration of changes evoked by measured amounts of exercise various workers have devised tests of adequacy of cardiac function and of cardiac reserve

Briefly, expected changes include temporary tachycardia and increase in the heart's output of blood with each beat (stroke volume), with return to resting levels at a rate depending upon the amount of exertion undertaken In healthy subjects changes in the pattern of the electrocardiogram do not ordinarily occur with exercise, when they do, they are thought to indicate a degree of cardiac insufficiency and a reduction of the reserve capacity of the heart

Tests of exercise tolerance have been difficult to interpret because factors other than exercise are capable of inducing tachycardia, increase in stroke volume (4), and even T wave changes (5) Prominent among such factors are life situations which are either consciously or unconsciously threatening to the security of the individual Situations of pleasurable anticipation may also be associated with tachycardia and an increase in stroke volume It is as if the bodily changes were occurring in preparation for exertion, e g fighting, running away, or active participation in some pleasurable situation When exercise is actually undertaken under such circumstances, the cardiovascular adaptation may be excessive or unduly prolonged during recovery, as if a much greater muscular effort had been anticipated

whom she saw little Her brother was a driving successful young man who by his example and to some extent by direct expression imposed high standards of performance on the patient When her elder sister married the patient had to assume a large share of the housework under the direction of her brother Intensely sensitive to the opinions of others she became excessively preoccupied with neatness and efficiency and disturbed by changes in her routine At 18 she married a man who was amiable but lacking in initiative and who earned less money than she did When she was 22, three years after the death of her father of coronary disease, her mother unable to live harmoniously with her elder daughter came to live with the patient The older woman, a diabetic, was rigid demanding and untidy The patient found her mother's behavior increasingly irritating She could neither chastise nor modify her However she was deeply dependent on her and prided herself on tolerating her mother when her sister had been unable to do so In this setting of conflict and anxiety palpitations began and continued until the patient came to the hospital one year later

The patient appeared as a neatly dressed, slender woman with an earnest intense manner She had rapid heart action (heart rate 90) and warm moist palms There was no evidence of structural heart disease The electrocardiogram was normal as was the basal metabolism (minus 4 per cent) The patient s eyes were prominent and the lids widely opened She expressed her feelings haltingly and with evident uneasiness about an entirely new experience Her sensitivity was demonstrated by her statement that even the discussion of someone else s illness evoked palpitations in her She complained of palpitations when on the subway chiefly in the morning on the way to work, rarely in the evening after work

At her first visit exercise tolerance as estimated from the pulse rate was considerably impaired as shown in Figure 1 As the patient was followed in the clinic successive tests of exercise tolerance were made The second test was made a few days after the sudden death of the patient s mother to which she reacted with considerable guilt and depression Although the resting heart rate was lower on this day, the exercise tolerance was impaired more than on the previous day During the interviews which followed the patient was able to talk more freely about her relations with her parents and brother She gained some understanding of her emotional development and in addition was reassured concerning the condition of her heart about which her symptoms had given added anxiety In the three months following the death of her mother

The remaining 16 had hypertensive, arteriosclerotic, rheumatic or congenital heart disease

Results

The 8 healthy subjects showed comparatively little variation in exercise tolerance On occasion, however, over a period of eight months of observation, each of these individuals developed "impaired" exercise tolerance during situations provocative of anxiety or anger

The 11 subjects who had complaints of palpitation and intolerance for effort would be classified by some as suffering from neurocirculatory asthenia Essentially, in the absence of structural heart disease, their cardiovascular apparatus overreacted to minor exertion and often displayed an "exercise pattern" when no extra muscular effort was being performed or consciously contemplated

In many ways these subjects with neurocirculatory asthenia were similar from the standpoint of personality adjustment as they were in their characteristic cardiovascular adjustment They were tense and timid and very sensitive to the hostility of those about them They lived in an insecure world full of emergencies For example

CASE A* *Impaired exercise tolerance associated with periods of anxiety in a young woman with symptoms of neurocirculatory asthenia*

A 24 year old housewife came to the New York Hospital with the complaint of palpitations which she had had for a year Other symptoms were tightness in the throat, pain in the left chest, difficulty in breathing, and light headedness The symptoms came on more often when the patient was sitting than when she was active Palpitations were particularly distressing after meals and during any stressful event or disturbing conversation On Sundays when she was at home and relaxed she was much better

The patient was the youngest of three children in an immigrant Polish Jewish family Her father was a butcher Her mother busied herself in his shop and spent little time with her children The patient's older brother 11 years her senior, largely took the place of her father, of

* Lettered cases are nonhypertensive patients, hypertensive patients are designated by numbers which correspond to those in Table VI

father a fireman who was accidentally killed when the patient was in his twenties His mother had died when he was 14 He became a casual irresponsible person who was sexually promiscuous and who lacked initiative in his work He became a steam fitter's helper but side-stepped all opportunities for promotion in his trade because of an unwillingness to assume further responsibility In his middle thirties he began to live with a Protestant girl who had already been married twice and who was separated from her second husband When he was 38 she bore him a child His palpitations began three years later when his wife finally achieved a divorce from her second husband and requested that he go through with his promise to marry her He felt unequal to the burdens of marriage and continually put her off He became sexually impotent and began to note palpitations

During his early visits in the clinic his rate was always rapid usually in the neighborhood of 130 On his first visit his blood pressure was 160/100 but thereafter was recorded in the neighborhood of 120/80 Physical examination electrocardiograms and radiologic examination of the heart were entirely normal The patient was a timid shy person who avoided the eyes of his interviewer and talked only with effort about his own feelings Anxiety was always prominent and he was largely preoccupied with gloomy forebodings of the future He was frightened about the condition of his heart He became very dependent upon the physician as he was on his wife expressing very little hostility directly The slightest unplanned for occurrence made him very anxious During a period of observation in the clinic from December, 1947 to March 1949 there was close correlation between his pulse rate at rest and immediately after exercise and his general state of security The ballistocardiographic pattern corresponded in similar fashion, indicating increased stroke volume at times of stress

When the patient first visited the hospital he was still unmarried but finally brought himself to accept and welcome the formalization of his relationship with his common law wife After this event and the assurance of support at the hospital he entered a period of relative security and relaxation Anxiety attacks and palpitations gradually diminished and exercise tolerance improved A little later he was paired with an uncongenial fellow worker with whom he was unable to exchange hostilities for fear of losing his job Symptoms of anxiety and palpitations once more increased and concomitantly exercise tolerance became impaired again Later he obtained new work and improved once more with complete disappearance of symptoms

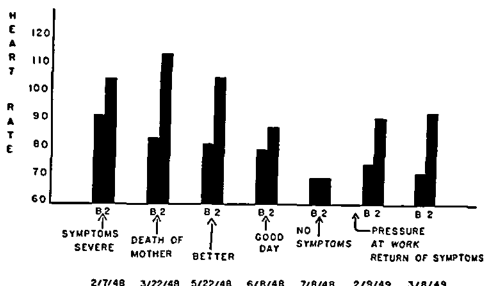


FIG 1 Variations in exercise tolerance from month to month in a patient with symptoms of neurocirculatory asthenia The heart rate was recorded before (B) and 2 minutes after (2′) the standard Master exercise test

the patient gradually improved and became free of symptoms Exercise tolerance was then normal

The patient remained completely well for another seven months At this time she arranged for her husband to obtain work at her factory, intending to resign from her own job and have a baby Her boss, who had obliged her by employing her husband, hinted that he would discharge him if she left the company The patient felt frustrated and tense, but was unable either to express her feelings to the boss or leave her job In this setting she had a return of the former symptoms in milder degree Although her resting pulse rate was only slightly higher than it had been, exercise tolerance was impaired and continued so for some months thereafter

CASE B *Impaired exercise tolerance associated with periods of anxiety in a tense timid man with symptoms of neurocirculatory asthenia*

A second patient with severe symptoms of neurocirculatory asthenia whose pulse rate reflected marked exercise intolerance, but who displayed no evidence of structural heart disease, was a 44 year old steam fitter's helper who for three years had had repeated episodes of palpitation, fatigability and weakness He was the second child of an Irish Catholic family of seven children He had been particularly close to his

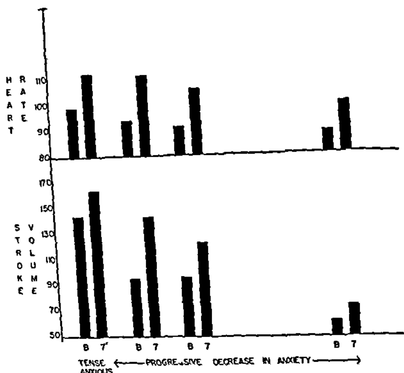


FIG 2 Variations in exercise tolerance in a patient with patent ductus arteriosus Values before (B) and 7 minutes after (7) the standard exercise are given

CASE D *Housewife with mitral stenosis whose exercise tolerance improved with reduced anxiety*

A second patient was a 45-year-old housewife who complained of palpitations at rest as well as upon exertion for the previous four years She was found to have an enlarged heart with mitral stenosis and insufficiency Frequent extrasystoles were noted For almost 20 years prior to the onset of her symptoms the patient had wavered in her attachment to two men One she had loved but feeling unsure of him she had married the other one who appeared to be stronger but proved to be unkind As her husband increasingly maltreated her she finally resolved to

Such changes as are observed occasionally in normal subjects and frequently in those with "neurocirculatory asthenia," characterized by an intolerance to exercise, would not be considered of grave import by most clinicians and many would attach no clinical significance to them when encountering them in patients *without structural heart disease* The same findings, however, observed in a patient with valvular heart disease, might have been interpreted as indicating an impairment of cardiac reserve and might, therefore, have led to an undue restriction of the patient's activities

The remaining 16 patients with various forms of structural heart disease were similarly studied All of these patients complained from time to time of exertional dyspnea and palpitations, which could reasonably be attributed to the structural disturbance in the heart It was observed, however, that these symptoms occurred at periods of stress and disappeared altogether during periods of relative serenity, *although the structural defects of the heart remained unchanged* For example

CASE C *Young woman with patent ductus arteriosus whose exercise tolerance improved with increased self confidence*

A 22 year old girl complained of weakness, dyspnea palpitations and dizziness She had always been warned to "take it easy" since a heart murmur was discovered in childhood Later following an unsatisfactory love affair she became depressed and developed palpitations She became more and more concerned about her heart She was found to have a patent ductus arteriosus which was identified by angiocardiographic examination

For 10 months she was followed in the clinic given strong reassurance and an opportunity to talk over her troubles As she gained confidence she became more relaxed and *her symptoms of effort intolerance disappeared* In Figure 2 are shown the comparative exercise tolerance tests during the early period in the clinic, as compared with the findings during the latter part of the period of observation It is noteworthy that the exercise tolerance was still impaired but to nowhere near the degree that it had been early in the course Obviously the congenital deformity in the heart had not changed during this period

that the changes induced during exercise were similar to those occurring during stressful interviews In 14 of these instances the heart rate immediately after exercise was nearly identical with that achieved during anxiety and therefore the electrocardiographic complexes were fully comparable In 8 of these the EKG during stress was identical to that following exercise In 4 the changes during stress were greater than those induced by exercise and in 2 instances the changes were qualitatively different

The changes observed in the EKG of one subject are shown in Figure 3 This patient, 32 years old at the time, had symptoms of palpitation and reduced exercise tolerance but gave no evidence of structural heart disease except for the EKG, which was normal at rest but in which T waves became inverted during exercise or during a stressful interview Seven years later the patient still showed no further evidence of heart disease

The mechanisms responsible for these EKG changes cannot be stated on the basis of the data at hand They may include coronary ischemia or perhaps merely sympathetic stimulation The in

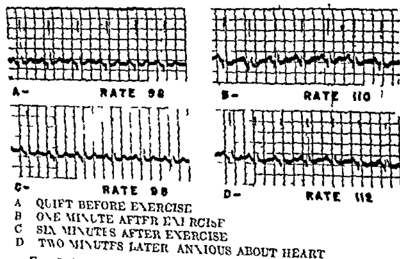


Fig 3 Marked depression of T waves in lead II of electrocardiogram Essentially the same change was observed after exercise and during discussion of a stressful topic

divorce him Palpitations began during the period of making this decision As she found difficulty in detaching herself from her husband she became anxious and tense, blaming both men for her unhappiness

The exercise tolerance at the height of this period of personal conflict was definitely impaired Her pulse rate three minutes after the standard exercise was still over 100, and measurements of the IJ wave of the ballistocardiogram indicated that "stroke volume" was nearly double that of the resting value Following this, during a seven month period of observation at the clinic, where she was given considerable emotional support and an opportunity to discuss her conflict, her symptoms greatly improved A second exercise tolerance test indicated great improvement The pulse rate three minutes after exercise was slower than the resting rate and the ballistocardiograph indicated less elevation of "stroke volume" than before

The relevance of stressful situations to serious disturbances in cardiovascular function has been studied by Reiser, Ferris, Levine (8), and recently reviewed

Electrocardiogram

Ordinarily when there are changes in the pattern of the electrocardiogram during exercise, the assumption is made that there is a disturbance of cardiac nutrition In the present study 19 patients displayed changes in ST segments or T waves of a degree considered significant according to the criteria of Master (9) following exercise performed during a period of stress Six of the 19, or approximately one third, failed to give any evidence of heart disease All had the symptoms previously described as characteristic of neurocirculatory asthenia and all but one were under 35 years of age The other 13 gave evidence of coronary arteriosclerosis In 3 patients, 1 with and 2 without other evidence of structural heart disease, exercise on a day of relative security and relaxation produced less change in the electrocardiogram than comparable exercise during anxiety

In 5 of the 6 patients with neurocirculatory asthenia and in all 13 of those with presumed coronary artery disease it was possible to produce electrocardiographic changes during an interview covering pertinent personal problems and without exercise or conscious anticipation of muscular effort The interesting fact was

CHAPTER III

CIRCULATORY ADJUSTMENTS INVOLVING RHYTHM OF THE HEART

Paroxysmal Tachycardia

Duncan and his colleagues studied 15 patients with paroxysmal auricular and nodal tachycardia and found that although individual attacks were often precipitated by such minor events as changes in posture, there was an underlying emotional disturbance which correlated very closely with the occurrence of attacks (10)

CASE E *Attacks of paroxysmal auricular tachycardia occurring in association with the discussion of family problems in a patient with congenital heart disease*

A 60 year old bank clerk and salesman had exhibited frequent extra systoles and paroxysmal auricular tachycardia intermittently over a period of 20 years The arrhythmias had occurred so frequently over the past 18 month as to make it impossible for him to continue working Shortly thereafter he developed congestive failure requiring digitalis He was a rather passive dependent per on, meticulous in his speech and dress who tended to deal with problems by withdrawal from them rather than by decisive action Examination revealed a congenital abnormality of both thumbs and congenital smallness of the left arm The heart was enlarged in all dimensions There were loud systolic and diastolic murmurs over the precordium and frequent extrasystoles when the patient was anxious Exercise tolerance was markedly impaired with dyspnea on slight exertion but otherwise there was no evidence of congestive failure Electrocardiogram showed marked right axis deviation right bundle branch block and prolonged PR interval A defect of the inter auricular septum was demonstrated by angiocardiography The diag

teresting thing is that the changes with stress resulting from threats, symbols or interpersonal relations are often similar to those following exercise.

The finding is in keeping with the general concept outlined above—that man during stress may react with his cardiovascular apparatus as if he were about to engage in strenuous muscular activity without any actual awareness of anticipating exercise. Thus the electrocardiogram recorded during severe anxiety in a man with suspected coronary artery disease must be interpreted in the light of these findings. Although the changes may be quickly reversible and may not always be of such grave import as is ordinarily thought, the possibility that repeated or sustained situational stress may lead to irreversible changes must be taken into consideration in planning therapy.

Summary

Exercise involving muscular work, requiring, as it does, an increase in peripheral circulation, calls forth a relatively uniform cardiovascular response. The extent and duration of the circulatory disturbance in these patients, however, did not correspond necessarily with the muscular work performed. In fact, the same response could be induced during rest merely by the anticipation of exercise and was often observed under circumstances of emotional stress without conscious anticipation of muscular effort. This was true whether the indicator of reduced exercise tolerance was the pulse rate, the height of the IJ wave of the ballistocardiogram, or the form of the electrocardiogram. It may be the symptoms of neurocirculatory asthenia are related to these disturbances in circulatory dynamics and to the fact that the "exercise" pattern of hemodynamic adjustment was often invoked without exercise but during contemplation of troublesome life situations.

still able to read large type and was by no means incapacitated by her imperfect vision he did little for herself and subsided into a state of dependency upon her parents who, in turn excluded her from the family counsels and in general treated her like a child After the death of her parents the younger sister continued this practice assumed supremacy over the siblings handled all financial transactions and virtually directed the patient s life

In her thirties the patient became pregnant without marriage Retrospectively at least she felt that the man involved would have married her but for the meddlesomeness of her family which drove him away Her parents urged her to allow her illegitimate child to be adopted, but she elected to raise him herself She did so with the help of her family including financial aid from her father After the death of her parents and a few years before her visit to the clinic she began to note palpitations in association with altercations with her sister She finally withdrew from the latter s home and went on relief ' During an interview in the laboratory while connected with the electrocardiograph frequent extrasystoles appeared as she answered the question How are you supporting yourself?

The personality structure, attitudes and general behavior of patients with extrasystoles gave evidence of a generally defensive reaction In most anxiety far outweighed hostility and sometimes approached abject fear The individuals tended to be timid, indecisive and passive They dealt with problems more often by evasion than by decisive action

Extrasystoles were often found among patients with structural heart disease but also *in association* with prolonged anxiety and an attitude of more or less frantic need for defense

Auricular Fibrillation

Eleven patients were found to develop auricular fibrillation under circumstances of stressful life situations

CASE G *Attacks of auricular fibrillation coinciding with periods of special stress in a man with no evidence of heart disease*

Paroxysms of auricular fibrillation with life stress may be separated by many years and then occur only under circumstances of sustained and mounting tension Thus a 49 year old man in a high executive office during the war year 1941 and in a setting of steady and unr[illegible]

nostic impression was that of congenital heart disease (Lutembacher's syndrome) on which arteriosclerotic changes had been superimposed

In childhood the patient had been dominated by several older, over protective sisters He finally married but was unhappy because his wife seemed to show a greater attachment to her aunt than to the patient During the period when the aunt lived with the couple the patient had his first two episodes of paroxysmal tachycardia After separation from his wife he returned to live with his sisters, where he enjoyed a 10 year period of freedom from attacks They recurred finally in a setting of friction with his two sisters who, he felt continued to dominate him and treat him "like a baby" He thereupon left his sisters and was again free of attacks until four years later, when they again recurred in relation to tension and frustration in his work He felt imposed upon and discriminated against by the officials of the bank where he was employed

Thereafter, with the exception of a brief remission during a period of unemployment, he continued to have frequent attacks of paroxysmal tachycardia up to the time of his first clinic visit three years later During this period he became increasingly apprehensive about his health and somewhat depressed During the interviews, on two occasions when the discussion was turned to the patient's difficulty with his wife and at the bank, the heart rate increased abruptly and the P waves of the electrocardiogram showed changes in configuration typical of paroxysmal tachycardia

EXTRASYSTOLES

In a group of 12 unselected patients with extrasystoles the life situation and emotional state of the patient appeared to be relevant to the occurrence of the arrhythmia in each patient (11)

Extrasystoles and associated anxiety were observed in these patients experimentally during a discussion of topics to which they were known to be sensitive, or which had previously been associated with extrasystoles

CASE F *Extrasystoles provoked by stressful interview with a middle-aged woman who showed no evidence of heart disease*

A 55 year old woman had grown up with a stern, domineering mother in whose presence she always felt uneasy and a father who was often depressed In childhood she had had frequent nightmares and bit her nails She had planned a career in music but abandoned the idea at the age of 17, after an attack of bilateral chorioretinitis Although she was

supply it more abundantly but he was afraid that any complaint would lead to their giving him even less

As noted, the patient was markedly obese The blood pressure was elevated in the neighborhood of 160/110 Apart from the arrhythmias frequently encountered there was little that was remarkable about the examination of the heart A striking feature noted in this and many of the other subjects of this group was moderate tachycardia even with sinus rhythm

He visited the laboratory one day following a painfully humiliating experience at the hands of his brother in law He had as usual restrained himself from speaking of palpitations but noted the sudden onset after the episode Electrocardiographic tracings revealed auricular fibrillation As he was urged to discuss the events leading to the attack he became more tense As he began to weep and sob expressing mixed feelings of resentment and depression numerous ventricular extrasystoles appeared 24 occurring in 24 seconds They persisted throughout the sobbing but disappeared completely when he had relaxed The basic rhythm of auricular fibrillation continued throughout and the ventricular rate of 164 remained unaltered during the period of observation

CASE II *Auricular fibrillation experimentally induced by a stressful interview with a young woman who had had hyperthyroidism*

A 34 year old housewife complained of palpitations She had not felt close to either parent although she had felt more attached to her mother than to her father a quick tempered butcher The first 10 years of the patient s life were spent in Rumania from 1909 to 1919 She recalled the unsettled conditions in Rumania during this time the famines and the invasion of the Germans with their foraging and raiding for food

The patient described herself as always nervous even as a child' Her husband said She has always been sensitive as long as I have known her and that s since she was about 15 She was always bashful and also very willful and hard to manage In youth she had had a goiter which became prominent when she was about 19 years of age When she was 24 she married Her anxiety continued throughout and gradually was blended into the full picture of hyperthyroidism This was characterized first by amenorrhea vomiting diarrhea and an increase in general nervousness Later after the onset of exophthalmos, paroxysmal attacks of palpitations with dyspnea

pressure concerned with national and international affairs developed auricular fibrillation The attack lasted about four days The patient had a regular rhythm until almost nine years later, when, at the age of 58, under somewhat similar circumstances of sustained tension with insomnia having to do with the long illness and ultimate death of his wife, he again developed auricular fibrillation This was ended in less than 48 hours by the use of quinidine Thereafter, he again maintained regular rhythm

Similar arrhythmias were exhibited by the following 3 patients carefully studied by Duncan, Stevenson and Ripley (10) at the New York Hospital

CASE 1 *An attack of auricular fibrillation recorded in a man with an apparently normal heart during the stress of humiliation*

A 40 year old man had been coming to New York Hospital since the age of 36 with hypertension and palpitations associated with attacks of paroxysmal auricular tachycardia and auricular fibrillation He was born of immigrant Russian Jewish parents and brought up in poverty The mother was the dominant member of the family Her attitude was tyrannical, and at one time she even had the patient arrested for a minor misdemeanor He tried a number of jobs haphazardly, but throughout most of his life he had supported himself by disposing of illicit goods At the age of 34 he was markedly obese and was found to have a blood pressure of 150/105 or higher At about this time he had his first episode of palpitations

At 36 years of age he married a Gentile girl who was 10 years younger than he was At first they lived separately, she with her parents and he with his mother, whom he was afraid to tell of the marriage When his mother ultimately forced him from her household after a quarrel he went to live with his wife and her family He was obliged to accept from them both financial support and humiliation His wife proved to be, like his mother a domineering personality They had frequent quarrels He resented the patronizing attitude of her brothers, and felt that his wife had not adequately protected him from the assaults of her relatives

In this patient, as in others, overt anxiety was prominent He expressed much of his hostility to his physicians, but it was almost impossible for him to do so in the presence of those toward whom it was directed He had been and was continually and fruitlessly seeking support from his mother, wife and relatives He resented their failure to

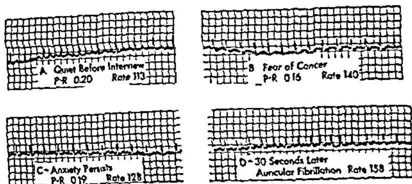


Fig 4 Depression of ST segment followed by the appearance of auricular fibrillation during a stressful interview (lead II)

tations herself until after he had left the clinic The attack stopped the following moring after the patient had given herself quinidine

Comment

A prolonged PR interval preceding the development of the arrhythmia has been frequently observed in patients who change from regular sinus rhythm to auricular fibrillation (12) This has been considered evidence of vagal activity but could also be the result of other factors influencing the conductivity of the heart The attack of auricular fibrillation in this patient occurred after the height of the emotional response (as judged by other criteria) and when the heart was slowing and presumably receiving more vagal impulses

Following the above observations the patient was seen several times in the outpatient department She entered a period of relative calm in her life and for three and a half months had no attack whatever Her heart rate was noted to be slower She said "Maybe I am more contented and at ease

During this period a hysterectomy was performed which had been previously deferred because of her arrhythmias At the same time her husband had a minor operation Shortly thereafter they were forced to move out of their apartment These circumstances brought back the patient s anxiety and attacks of auricular fibrillation recurred As before, fatigue and stressful situations were the commonest precipitating factors

ectomy the patient "felt like a new person" for about a year Then her brother entered the Army and her sister in law was obliged to work Care of their three children devolved on the patient who, once again be gan to have frequent attacks of palpitations

After about a year a second thyroidectomy was performed, but she continued to be tense and anxious and to suffer from episodes of parox ysmal auricular fibrillation, many of which were observed in the clinic They occurred about twice a month in settings of tension and fatigue

She was extremely meticulous about the care of her house, quick tempered and slept poorly "People annoy me I don't know why Even if I go to the theater and someone chews gum, I could scream If things don't go my way right away, I scream" She had difficulty with decisions She was reserved and tense during interviews and when asked to relax became more tense Even when given 0 4 grams Sodium Amytal intra *venously she remained completely alert and said later she had been afraid* "to let go," in case she might say things she did not want to say

Her chief anxiety was her health She was particularly concerned *about excessive menstrual bleeding which had been attributed to the* presence of uterine fibroids Her grandmother had died of cancer and she visualized a similar end for herself

Examination revealed no enlargement of the heart and there were no murmurs The blood pressure was 120/80 The heart rate was usually accelerated, almost invariably above 80 and more often around 100 X ray examination of the chest revealed no unusual cardiac configuration The electrocardiogram, besides showing the tachycardia, revealed the PR interval prolonged to 0 21 seconds and a negative T wave in lead CF_4 BMR was not elevated at this time

The patient was interviewed while electrocardiograms were being taken Initially she was extremely tense and anxious and there was sinus tachycardia with a ventricular rate of 113 The PR interval was 0 20 seconds (Figure 4) The patient's health was then discussed with her As she described her worries over her health she became even more anxious than before She spoke of the fear that her menorrhagia was due to cancer As she said this she became more agitated and began to weep The heart rate rose to 140 and then fell again to 128 She continued to be anxious and a tracing taken 30 seconds later showed the presence of auricular fibrillation with a ventricular rate of 158 This arrhythmia persisted throughout the rest of the interview, during which the patient was strongly reassured and urged to relax She did not become aware of palpi

she said "What happiness did they ever have to give me?" When she was 18 years old she came to the United States and shortly thereafter married. There followed a period of depression which lasted for some years during a return visit to Europe and finally cleared when she returned to the United States. Thirteen years later the death of her son was followed by a second major depression.

The patient then remained well until the age of 56 when, shortly after the outbreak of World War II, she undertook to bring a 15-year-old niece from Europe to the United States. When the girl arrived to live with the patient, she was willful and headstrong. The patient reacted to her ingratitude and disobedience with unexpressed anger, frustration and depression. It was at this time that she had her first episodes of arrhythmia. Following the marriage and departure of her troublesome niece two years later the depression lifted, the arrhythmias ceased and the patient was able to resume work. During the next five years the only arrhythmias were in the immediate postoperative period following the removal of a large meningioma in the region of the left sphenoidal ridge. Because of residual loss of function of the left eye, the patient was unable to return to work, and when 18 months later her husband's health began rapidly to fail, she again became depressed and had frequent attacks of paroxysmal auricular fibrillation.

Paroxysmal Ventricular Tachycardia

CASE J *Attacks of ventricular tachycardia occurring in association with stressful events in a confused and insecure young man**

A 34 year old maker of orthopedic appliances was referred to the New York Hospital in November 1952 because of paroxysmal tachycardia.

He had been in good health until June 1945 when he experienced the abrupt onset of rapid heart action which was accompanied by a sense of constriction in the chest and throat, and which ceased abruptly in about 10 minutes. Over the next five years until September 1950 he had about 30 such attacks lasting from a few minutes to two days. During attacks distress was only moderate, and between attacks he felt well, although he experienced occasional extrasystoles. An electrocardiogram taken during an attack in September, 1948 showed ventricular tachycardia. Between September 1950 and March 1952 he had no cardiac symptoms. Brief

* This patient was independently studied and reported under the title Paroxysmal ventricular tachycardia in an apparently normal heart. A. Ring and J. Blackfein. Annals of Int. Med. 42: 680, 1955.

Thus, one episode of arrhythmia came on after a visit to the gynecology clinic in which some misunderstood remarks of the physician filled her with anxiety Another occurred when she was asked if her husband would come to the clinic to discuss her illness with the physicians She interpreted this to indicate a forthcoming revelation of bad news and again with anxiety developed auricular fibrillation

CASE I *Correlation of attacks of auricular fibrillation with difficult life experiences over a period of eight years*

A 64 year old Jewish housewife and beauty shop operator who had had a number of attacks of paroxysmal auricular fibrillation over a period of eight years had reacted for the past year to her husband's failing health and the growing certainty that all her relatives in Europe had been killed during the war with increasing depression and frequency of arrhythmias She spent the days at home alone "just thinking, thinking thinking" of her many misfortunes In addition to frequent arrhythmias she complained of poor sleep, weight loss frequent crying spells and a feeling of hopelessness

The patient was a serious, conscientious self sacrificing person who had always taken great pride in her work as a beauty operator *She was* anxious and worrisome and when first seen rather profoundly depressed She was quite dependent, seeking support, approval and reassurance from every possible source Examination showed a surgical defect of the skull in the left temporal region and impaired function of the left cranial nerves 2, 3 4 5 and 6 (residual of operation for a meningioma in the region of the sphenoidal ridge) The heart was generally enlarged and there was a harsh apical systolic murmur and a low pitched diastolic murmur characteristic of mitral stenosis The blood pressure was 196/100 Electrocardiogram showed sinus bradycardia (38 to 58) left axis and PR interval of 0 22 to 0 24 seconds During the attacks the electrocardiogram showed auricular fibrillation with a ventricular rate of 76 to 100

The patient described her father a Hungarian factory worker as shift less, irresponsible generally very easy going but subject to outbursts of temper The relationship with him was never good and she was quite critical and resentful of his lack of responsibility and affection for his family She identified herself rather with her mother who was an unaffec tionate bitter, melancholy woman described as 'always crying The patient was the oldest of six children to survive infancy Her early life in Central Europe was one of poverty and deprivation Of her childhood

married a German girl and had two children by her He was captured by the Americans shortly before the German collapse Since he spoke English fluently he served as an interpreter and succeeded in obtaining some favors for his fellow prisoners He actually met one American soldier who had been a schoolmate in New York His fellow prisoners continued to regard him as a good German soldier so that he received severe treatment from his captors He was surprised and angered that he should be treated as a hated enemy He lost weight to 100 pounds He had had little enthusiasm for the German campaign in the west but had been convinced that the German campaign in Russia was in a just and righteous cause He could not understand why the Western Allies had not joined Germany in this war against Russia While still in prison camp a few days after he had learned that the Russians had occupied Eastern Germany and that large segments of Eastern Germany would be ceded to Poland he developed his first attack of tachycardia Soon after this he was released from prison and returned to Western Germany to join his family After a brief period of serving as interpreter for the Occupation Forces he went into the wholesale textile merchandising business with his father in law

Over the following years the business did increasingly well and the attacks of tachycardia decreased in frequency until they ceased in 1950 Although his family s economic situation was better than most he became convinced that his children would be better off if they were raised in the United States His parents urged him to come and assured him that there would be good job opportunities here In December 1951 he brought the family to this country

Things did not go as well as he had expected Living conditions with his parents were crowded and he was forced to find an apartment for his family before he could afford it The only job he could obtain was in a small firm which made orthopedic appliances His duties included opening the mail and doing relatively unskilled work in connection with the manufacturing There were several American veterans working closely with him and there was a good deal of kidding about the war and his role in it The patient became moody and depressed, convinced that he had made a mistake in returning to this country The attacks of tachycardia returned Because of his absences from work his wife was forced to go to work as a cleaning woman His illness served to deepen his feelings of failure hopelessness and despair He was too proud to accept public assistance— What would people say? These krauts shoot at us and then come over here and take our money "

attacks occurred in March and April, 1952 A 10 day attack in July, 1952 led to his hospitalization at another institution with the symptoms and signs of congestive failure Electrocardiogram showed ventricular tachycardia which reverted to normal rhythm after the administration of procaine amide intravenously His course was complicated by pulmonary infarction Two briefer attacks of ventricular tachycardia confirmed by electrocardiogram were treated with intravenous procaine amide in August and November, 1952 He was referred to the New York Hospital for further evaluation At that time his physical examination, electrocardiogram and chest x ray were normal

The patient was born in a small city in Southern Germany, the only child of upper lower class parents He described both parents as kind just and considerate, but cold and undemonstrative He characterized his early training as 'typically German " Though neither parent used physical punishment, he always assumed that the wishes of either parent were to be obeyed without question From the time of his earliest memories he was extremely neat, compliant and sweet tempered He does not recall having fought with anyone— 'I'm a good guy I never wished anybody any harm "

When the patient was 5 years old his parents decided to seek new economic opportunities in the United States They left him with his grandparents and came to this country When the patient was 10 he joined them here and remained in this country, attending school until he was 19 He did moderately well in school, enjoyed meeting people and participated actively in sports, excelling in aggressive sports He made acquaintances easily but had few close friends When he was 19 he visited his grandparents in Germany and decided to stay on to complete his secondary schooling After completing his schooling he entered a manufacturing firm in Germany as a member of the accountancy staff He did well at his work and enjoyed life in Germany The hours were good, there was promise of steady advancement there was considerable security and opportunity for recreation including a soccer field and team maintained by the company He was sympathetic to the Nazi movement, though it is not known whether or not he joined the party He resolved to spend the rest of his life in Germany

In 1939 he was drafted into the German army He became a noncommissioned officer in an artillery signal battalion, and served on the western and eastern fronts During the Russian campaign he was sentenced to five weeks in a labor battalion in Poland for having said that he wished he were back in the United States During his army service he

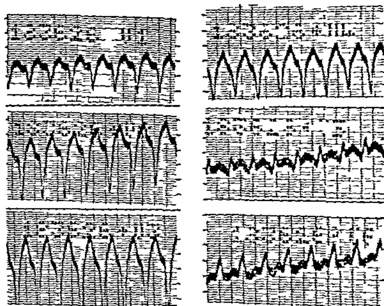


FIG 5(B)

his feelings about America and Americans caused intense flushing of the face and ears At the end of one such discussion he stated, I'm all worked up to a pitch I don t feel good If I stay this way for a week or so I get an attack On one occasion during such a discussion the patient got up abruptly and left the room

Although the patient was probably quite aware of the connection between his feeling states and the attacks he refused to come frequently to the clinic giving as an excuse his need to work whenever possible

Since July 1952 he had been receiving prophylactic procaine amide orally and before coming to the clinic had developed two attacks while receiving the drug Although there was little evidence of progress in the therapeutic situation he was free of attacks for the next six months In July 1953 a veteran who had recently come into his firm was promoted despite the patient s seniority The patient promptly quit his job because of this supposed injustice *His wife* and his parents criticized him for this action Unable to find another satisfactory job he had two attacks of ventricular tachycardia in July requiring hospitalization in another institution and he developed another in August 1953 while waiting to be seen in the clinic of the New York Hospital

He was promptly hospitalized The electrocardiogram showed ventric-

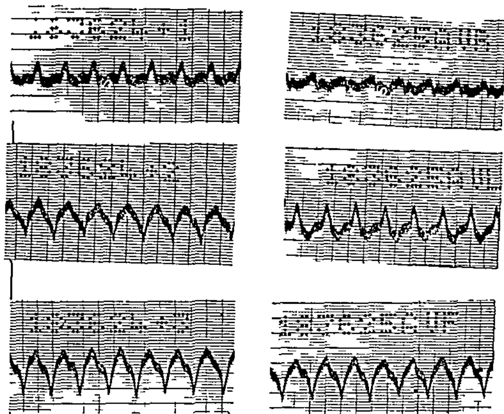


FIG 5(A)

FIG 5 (A & B) Ventricular fibrillation occurring under stress in an apparently healthy man without evidence of structural heart disease

The patient was agitated, depressed and discouraged and on the verge of tears His manner towards the examiner was smiling self deprecatory cooperative to the point of servility and never directly hostile Hostility towards the examiner was expressed largely in terms of criticism of any plan of therapy disbelief in its possible efficacy and criticism of other physicians During interviews there was great motor activity, pounding of the table pounding his fists into his hands, swinging his head from side to side, pacing the room, and rubbing his face with his hands He at first denied anger over his present situation but in the same interview engaged in what were for him unusual outbursts of anger towards his wife during the time he had been in this country If things keep up this way I'll eventually go crazy That thought is getting stronger and stronger When I'm convinced of it I'll really go crazy I might kill some one then "

Any discussion of the treatment he received in the prison camp or of

CHAPTER IV

CIRCULATORY ADJUSTMENTS INVOLVING PERIPHERAL VESSELS

The peripheral vasculature is capable of a rich variety of responses local, regional and general, to many stimuli Such changes in vascular function produce thermal, nutritive and other effects

Peripheral Arteries

Two familiar syndromes, migraine and Raynaud's disease provide examples of vasomotor alterations in regional arteries which produce widely different symptoms Both appear to be related chiefly to the attitudes and personality adjustment of the affected individual

Vascular Headache of the Migraine Type

This disorder has been dealt with in detail in separate publications on headaches (14) (38) Briefly it may be stated that the migraine attack ordinarily starts with a painless constriction of branches of cranial arteries often on one side of the head If the arterial constriction involves vessels anywhere along the optic pathways scotomata of various types may occur If it implicates other areas of the brain other localizing manifestations may occur during the preliminary phase of the migraine attack Most commonly however migraine involves branches of the external carotid arteries outside the skull Thus *pallor of one side of the face* may be the only premonitory sign of an approaching migraine headache

The second phase of the attack is arterial dilatation which

ular tachycardia as shown in Figure 5A and 5B After approximately 2 grams of procaine amide intravenously the rhythm reverted to normal but in the electrocardiogram there was inversion of T waves in the precordial leads *Temperature, sedimentation rate and white blood count* remained within normal limits and the electrocardiogram rapidly returned to normal His enforced stay in the hospital was used as an opportunity to emphasize the necessity for his accepting community help Through the efforts of the social service worker a job with adequate salary, offering on the job training as a machinist, was procured Oral quinidine was substituted for procaine amide as a prophylactic measure and the patient was discharged with the advice to work up to eight hours daily at sedentary work

At the time of this writing he has been free of attacks for three and one half months His outlook is optimistic He feels that he and his family will be able to adjust adequately to life in this country and that his decision to come to the United States was a wise one

Summary

It has been observed that arrhythmias including paroxysmal auricular tachycardia, extrasystoles, auricular fibrillation, and even the more serious paroxysmal ventricular tachycardia, occur in association with troublesome events in the day to day experiences of individuals who have no other detectable evidence of heart disease It would appear that this variety of disorders of cardiac rhythm may be precipitated by or possibly fundamentally related to threats arising out of the life situation It is certainly unnecessary to postulate underlying structural disease of the myocardium as a cause of arrhythmias even in the case of such potentially serious disorders as auricular fibrillation and ventricular tachycardia It is noteworthy that paroxysmal ventricular tachycardia has also been reported by Harvey and Levine in association with emotional stress (13)

dex fingers The nails were brittle and there was thickening and fissuring of the finger tips

The third of eight siblings she had been a quiet, timid child She had no sex enlightenment before her marriage at the age of 16 Her husband mistreated and beat her The patient bore him one child but divorced him after five years

She married for the second time at the age of 22 During her third pregnancy (second in second marriage) her husband began to give her less money for the household The subject then feared that her second husband was about to mistreat her as had her first She was worried and enraged It was at this time that she had the first painful attacks in her fingers which were more frequent and more severe during exposure to cold

Figure 6 illustrates the course of finger temperature during two separate observations carried out at a room temperature of 20 5 C During the control observation extending over a two-hour period and illustrated by the solid circles there was no significant drop in finger temperature and no Raynaud s attack When however following a similar stable hour long control period a discussion of her family difficulties was abruptly undertaken skin temperature of the fingers fell precipitously 13 degrees centigrade and an attack of cyanosis and pain ensued With strong reassurance and diversion the attack subsided and the finger temperature returned to its former level although the room remained at 20 5°C

More recently Bey has reported isolated occlusive spasms of larger arteries occurring in situations of stress (16)

Cutaneous Arterioles Capillaries and Venules

In the studies of Graham the skin temperature and the reactive hyperemia threshold (see below) were employed as measures of cutaneous vascular function since they reflect, respectively, the activity of the arterioles *and the* minute vessels (17) It is important to consider these two distinct kinds of blood vessels separately in view of the facts that they may act independently, and that they determine different aspects of skin reaction The arterioles as the site of most of the peripheral resistance to blood flow control the cutaneous flow and hence determine the hue of the skin—blueness or redness—because the degree of hemoglobin

allows for painful stretching of the vessel walls by the blood coursing through them This usually induces a high intensity *headache, often localized at first, but frequently becoming gen*eralized before it is over

Changes in the cranial vasculature are not the only features of the migraine attack There may be also associated metabolic changes, including an initial retention and then diuresis of salt *and water, the production of ketone bodies by the liver and in*crease in the elaboration of thyroid hormone

This whole chain of events is typically set off in a suitably susceptible person by a threatening life situation Migraine sufferers as a group are people who live by a philosophy of gaining security *and approval by doing things better than, longer than and harder* than their neighbors Generally, they take responsibility well and criticism poorly They do not like to appear off guard and thus dislike unplanned activities, have difficulty relaxing in company, and lack spontaneity Situations which threaten their security sys*tem are likely to be the ones that set off attacks with the char*acteristic diphasic alteration in cranial vasculature

Raynaud's Syndrome

The second familiar condition which involves peripheral arteries is *Raynaud's syndrome In this disorder the circulation of the* fingers and toes is periodically compromised by a tight constriction of nutrient arteries Color changes in the skin occur and often there is ischemic pain Difficulty is much more prominent in winter than in summer and individual attacks are often precipitated by chilling Threatening life situations are equally capable of setting off attacks in suitably susceptible subjects as shown by Mittelmann and Wolff (15) and illustrated by the following patient

CASE K *Induction of an attack of Raynaud's Phenomenon in a young woman during a discussion of family troubles*

The patient, a woman in her thirties complained of having had, for five years, attacks of pain and cyanosis in her fingers extending at times up to the second and third phalanges particularly of the middle and in

will affect the linear velocity of flow, independently of the influence of the arterioles on the quantity of blood delivered per unit time In these smaller vessels the exchange of fluid and solutes with the tissues occurs

In the triple response of Lewis (26), both kinds of vessels are dilated The dilated minute vessels are responsible for the "red reaction, and dilated arterioles for the 'flare" Lewis believed that it was necessary to postulate a third factor to account for increased capillary permeability and wheal formation, but his arguments are not conclusive in view of the probability, according to Ponder (18) that a dilated capillary is *ipso facto* a more permeable one Since dilatation of arterioles reduces the usual pressure drop in the blood passing through them thereby raising the intracapillary pressure wheal formation may be viewed as the result of increased transudation of fluid consequent to increasing the pressure in a dilated and hence more permeable capillary

Skin temperature and therefore the caliber of the arterioles was measured with a Hardy radiometer (19) The state of the minute vessels on the other hand was ascertained by measurement of the reactive hyperemia threshold according to the method of Di Palma Reynold and Foster (2) This is a test of tonus, that is, of resistance to dilatation and not of the actual caliber of the vessels The test consists of applying a weight to the skin long enough to produce after it is removed, a change in intensity of skin color i e a zone of erythema due to minute vessel dilatation The end point of the test is that length of time required to produce a complete ring of hyperemia in the skin without spread of erythema to skin on which the weight was not resting If minute vessel tone is low the time required is short, if the time required is long tone is high All measurements were made on the skin of the ventral surface of the forearm

The experiments were carried out at room temperatures varying between 22°C and 28°C The temperature of the room in each experiment was maintained constant Rarely did it vary as much as 1 5° during any single experiment When there was evidence that skin temperature changes might be reflecting changes

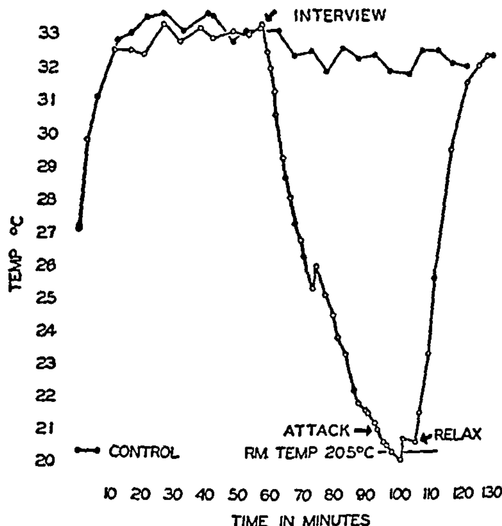


FIG 6 The precipitation of an attack of Raynaud's phenomenon during a stressful interview Finger temperatures are recorded over a two hour period and compared with readings obtained at the same room temperature but during relaxation and comparative serenity

reduction is a function of among other things the rate of flow The latter also is a major factor determining skin temperature The *minute vessels*, the capillaries and venules which need not for present purposes be further distinguished control the saturation of skin color, and if they are constricted the skin is pale, no matter what the total blood flow may be They may also have some effect on the skin hue, since the size of the capillary bed

with changes in the life situation, attitude and feeling state in 30 patients with chronic urticaria Three procedures were employed life history material was correlated with the appearance and subsidence of symptoms material thought to be symptom provoking was deliberately introduced during interviews and resulting skin changes were measured response to vasodilating agents in the patients was studied and compared with that of a control group

In 29 of the 30 cases there was found an almost invariable relationship between a feeling state of a particular kind and attacks of urticaria The single exception was a girl who made only two visits to the clinic and even in her it was possible to identify the particular emotional pattern seen in the others but it was not possible in the limited time available to correlate attacks temporally with these feelings

In brief these patients considered themselves wronged or injured (usually by someone in a fairly close family relationship) and they regarded the traumatizing situation as one which precluded any action on their part They felt that they could neither retaliate nor run away In this setting they became intensely resentful and developed urticaria

Feelings of anxiety hostility grief or dejection were not directly associated with attacks of urticaria though of course, many of the patients experienced some or all of these feelings at various times in addition to resentment

Vascular Changes During Stressful Interviews

All of the subjects were seen to flush when topics of significant personal concern evoking resentment were brought up for discussion The flush was usually blotchy and of varying intensity, but it often extended at least as far as the waist and wrists Five subjects developed urticarial lesions while discussing their problems

In 20 of the patients the reactive hyperemia threshold was followed during interviews on one or more occasions When resentment was aroused by a discussion of events which in the past had been associated with attacks of hives capillary tone was

in the environmental temperature the observations were omitted from consideration

In addition to the measurements made during experimental interviews, sensitivity of the skin to histamine and pilocarpine introduced by iontophoresis was determined in 24 of the patients and in 24 controls, 20 of whom were healthy hospital personnel and 4 patients without skin disease One square cm of canton flannel was saturated with the solution being tested, and a current of 100 microamperes allowed to flow for two minutes The active electrode was a square of aluminum foil The solutions employed were histamine acid phosphate 0 001 per cent and pilocarpine hydrochloride 1 per cent

In a few individuals, the response of the skin to warming the body by soaking the legs in water 43°C to 45°C and to the intramuscular injection of 6 milligrams of pilocarpine hydrochloride was also investigated In general it was found that the vulnerability of the skin related to cutaneous vascular alterations varied with the state of adjustment of the individual as a whole Bilisoly and his associates have recently confirmed the notion that such altered vulnerability depends upon peripheral nerve activity (20)

Urticaria

Graham extended his studies by way of an investigation of patients with urticaria (17) The association of urticaria with stressful life situations has been observed by numerous authors (21–25), but there are few available data concerning the mechanisms involved Grant, Pearson and Comeau (22), who studied urticaria occurring with exercise warming the body and "emotion" found that parasympathomimetic drugs produced hives in susceptible individuals *Hopkins, Kesten and Hazel* (23) confirmed their findings These workers inferred that urticaria in their patients resulted from a hypersensitivity to acetylcholine released at nerve endings during the resulting vasodilatation

Lewis (26) demonstrated the importance of cutaneous vascular changes in the production of wheals Accordingly, in Graham's investigation *measurements of blood vessel function* were correlated

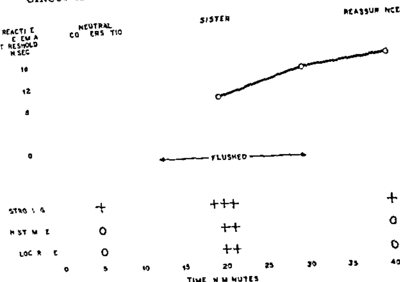


FIG 7 Simultaneous changes in the response of the skin to histamine to pilocarpine and to stroking during a stressful interview with a woman patient (Histamine acid phosphate 0.001 per cent and pilocarpine hydrochloride 1 per cent at only 10 microamperes for two minutes over 1 square centimeter) There was no response to physiological saline applied in the same way before during and after the period of stress

and 23 responded with whealing to pilocarpine Physiological saline solution applied in the same way gave rise to whealing in only 1 patient and the response was very much less than that to the other two solutions In 2 cases the test to pilocarpine was negative on the ventral surface of the forearm where the individual concerned never developed lesions but was positive on the chest and thigh respectively where lesions often did occur

In 25 control subjects response to histamine was seen in only 6 and to pilocarpine in only 3

Attempts to provoke urticaria by soaking the legs in hot water were successful in 3 of the 4 patients in whom the procedure was tried One of these developed lesions over most of the body surface These began to recede promptly when atropine sulfate was injected corresponding to the experience of Grant et al (22) The injection of pilocarpine was followed by the appearance of wheals

invariably lower than during control periods Moreover, in individuals who developed hives during interviews the reactive hyperemia threshold was low while lesions were appearing

In 13 cases measurements of forearm skin temperature were made In 11 of these it rose when the subject became resentful, at the same time that minute vessel tone was decreased One individual who discussed his problems without any indication of distress showed no significant changes in skin temperature The skin temperature of another failed to rise when the interview elicited only grief and dejection, accompanied by weeping

When chiefly anxiety was experienced, the minute vessels gained tone and the arterioles constricted Associated with predominant feelings of dejection and hopelessness there was a loss of minute vessel tone but a lowered skin temperature, probably indicating arteriolar constriction This conforms with the clinical experience that these feeling states are not associated with attacks of hives When the interview was not stressful no significant changes in either groups of vessels were noted

In 1 subject (Figure 7) it was possible to demonstrate simultaneous changes in the response of the skin to histamine, to pilocarpine and stroking during a stressful interview The minute vessel tone, which was low when measured at the height of skin reactivity, increased as the response to the other stimuli decreased In 2 other subjects similar changes in the response to stroking during a single interview were observed

Sensitivity to Vasodilating Stimuli

Every one of the hives patients manifested dermographism (wheal formation in response to a single moderately strong stroking of the skin), although in some this was not apparent until stressful interviews had altered the state of their skin vessels "Spontaneous" lesions often occurred at sites of mild mechanical trauma, such as under belts, collars shoulder and wrist watch straps

Iontophoresis skin tests were performed on 24 of the patients without any effort to induce resentment at the same time Twenty three of them responded with at least some whealing to histamine

a blow produced a similar fall, though only in the threatened arm Real trauma to the skin therefore leads, as would be expected to those vascular changes which are associated with hives and the changes can in part at least be elicited by merely threatening such trauma

Ten of the 30 patients showed at one time or another diastolic blood pressure of 100 mm Hg or more 5 others had one or more diastolic pressures between 90 and 100 mm Hg The highest readings were usually obtained during discussions of the life situations associated with hives and on the few occasions when the cutaneous vascular changes were measured concomitantly with the greatest cutaneous vasodilatation

Eczema

Eczema was found to be associated with the same cutaneous vascular changes as hives (27) The eroded moist scaling infiltrated skin lesions appear to be attributable in large part to the trauma of scratching Itching occurred by reason of the relatively sustained dilatation of arterioles and minute vessels of the skin which lowered the sensory threshold for itch The attitudes of the patients were marked by feelings of frustration inability to cope with challenges guilt and a need for punishment When topics were discussed which aroused such attitudes patients with recurrent eczema developed the same vascular changes observed among those with urticaria associated with a strong desire to scratch Thus it would appear that important changes in function of the arterioles and minute vessels of the skin may occur as part of an individual's adaptation to threats and symbolic assaults As a result of the associated increased vulnerability of the tissues a variety of lesions may result from ordinarily well tolerated minor traumata

Vessels of Mucous Membranes

The stomach of the fistulous subject Tom reported in detail in another book (6) was examined carefully and for long periods under a dissecting microscope (28) The magnification was such that one could observe the venules which surrounded the neck

at different sites in 4 of 8 patients Both procedures resulted in marked flushing of the skin in all patients tested

In 4 patients who continued to come to the clinic after becoming completely free of hives, the response to the skin testing of histamine and pilocarpine in the dilutions previously used could no longer be elicited

Vascular Changes Following a Blow

Since the patients saw themselves as "taking a beating," it seemed pertinent to compare the changes in their skins with those which follow a real blow It is a matter of common experience that a blow on the skin is followed by a rise in skin temperature Figure 8 shows the effect on the minute vessel tone of a healthy man of a blow on the forearm It will be seen that the threshold dropped on both arms following the blow, and also that feigning

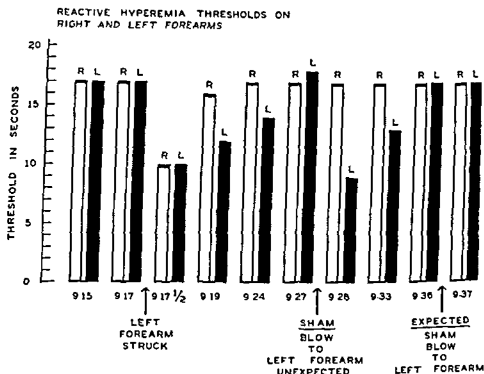


Fig 8 Changes in the reactive hyperemia threshold of both forearms of a healthy man in response to real and feigned blows to the left forearm

Relation of Vasomotor Changes to Integrity of Tissues

Ischemia

One way in which actual tissue damage may occur in response to changes in the function of peripheral blood vessels is through ischemia secondary to arterial constriction It is well known in Raynaud's syndrome for example, that damage to or loss of terminal phalanges may follow prolonged or persistently recurrent attacks

In migraine permanent ischemic damage to the brain has been shown to result from the preliminary vasoconstrictor phase when it has been exaggerated in degree or duration (30) Cerebrovascular accidents have also been described in young individuals during periods of stress and special proclivity for cerebral vascular contractility has been observed in such subjects by Seidenberg and Ecker using angiocardiographic technics (31)

Engorgement and Hyperemia

During the vasodilator phase of migraine, tissue damage may also occur Subcutaneous extravasation of blood has been observed in an area where no mechanical traumata had been applied but where there had been extreme vasodilatation of a branch of the superficial temporal artery during an unusually intense migraine headache

The hazards of sustained engorgement of tissue, especially mucous membranes include a lowering of pain threshold and an increase in tissue fragility In experiments on the stomach of the fistulous subject Tom it was repeatedly observed that noxious stimuli which did not induce pain when applied to the mucosa in its usual state did so when the membrane was in a state of sustained hyperemia and engorgement Likewise, relatively minor traumata such as striking the membrane with a blunt glass rod or drawing a square of gauze over it, failed to produce a visible lesion when the membrane was in its usual state, but such maneuvers produced small hemorrhagic spots and erosions when they were applied to the chronically engorged mucosa Often, in fact, small eroded areas appeared, apparently spontaneously, during a



Fig 9 Microscopic picture of gastric mucosa showing glandular parenchyma (white strands) immediately adjacent to venous channel Large white spots are refractory mucus

of the gastric glands like small lakes (see Figure 9) These vessels were seen to undergo narrowing and widening which amounted *to a change in diameter of the vessel of 400 per cent* Situations productive of an attitude of withdrawal and marked by abject fear, apathy or dejection were accompanied by narrowing of these periglandular blood channels and a corresponding decrease in secretion of acid and other glandular products On the other hand, situations productive of an attitude of fighting back and marked by hostility and resentment were accompanied by engorgement and dilatation of these venules with increased glandular secretion

Similar changes were noted in a separate study in the vasculature of the colon (20).

CHAPTER V

ESSENTIAL HYPERTENSION—NATURAL HISTORY AND SYMPTOMATOLOGY

IN ADDITION to those outlined in the previous chapter, another disorder which appears initially to involve mainly peripheral vessels is essential hypertension. The diagnosis is one of exclusion and is made only in the absence of a discoverable reason for hypertension such as congenital vascular anomaly, endocrine tumor or primary renal disorder. The label 'essential hypertension' is attached to a patient who is consistently observed to have an elevation of systolic and diastolic blood pressure at the times when he is examined by his physician. There are no symptoms directly attributable to an elevation of arterial pressure and yet patients with hypertension usually have symptoms. In order of frequency in our experience they are giddiness, muscle tightness in the neck, back or extremities, headache, palpitation, constipation and epigastric discomfort. None of these symptoms is very closely related to the level of blood pressure and serious hypertension may exist without these or any other symptoms being present.

THE ELUSIVE NATURAL HISTORY OF ESSENTIAL HYPERTENSION

The natural history of a disease describes a prototype in terms of epidemiology, manifestations, course and outcome. Knowledge of the natural history of any disorder may be of value in establishing a diagnosis, in prognosis and in therapy, especially in the evaluation of new or alleged therapies. Pernicious *anemia*, subacute bacterial endocarditis and most forms of malignancy describe natural histories that are uniform enough to endow the

bout of unusually vigorous motor activity when the gastric mucosa was especially engorged

These general findings have also been observed in studies on other mucous membranes, including the nose, colon and bladder In the case of the stomach it was of special interest that the gastric juice produced was capable, by continuous contact over a three day period, of causing a sizeable ulceration with a sharply circumscribed border and a granular base Added significance derives from the fact that this ulcerative process could occur without pain, although the lesion itself was tender to mechanical and electrical stimuli

The lesions and erosions in mucous membranes which have been described have been recognized because they occurred in areas that were accessible to inspection There is every reason to suspect that vascular changes elsewhere in the body and less accessible to view may produce similar changes and ultimately, perhaps, potentially irreversible tissue damage in important organs

Summary

Many important disturbances involving peripheral vessels are not customarily classified among cardiovascular disorders These include vascular headache, Raynaud's syndrome, hives, eczema, and various disorders of mucous membranes The vasomotor mechanisms which appear to be responsible for these phenomena have been shown to be set in motion by a variety of stimuli, including situations or events which have a threatening significance to the individual

do with the level of blood pressure and do not offer a reliable guide to prognosis Neither did the height of the arterial pressure or its variability correlate with incapacity or duration of life Generally speaking however, blood pressures were higher among those who developed malignant forms, usually recognized by rapidly progressive arteriolar degeneration and manifest by the presence of retinal hemorrhages and exudates Ferris group had the largest number of patients with malignant hypertension, one in four They found uremia to be the single most ominous finding

Patients with malignant hypertension survived a much shorter time than did those with the benign form although occasionally manifestations of malignancy cleared up, thereby improving prognosis In all of the series patients with both benign and malignant forms developed congestive heart failure but those with benign hypertension tended to die with arterial rather than arteriolar complications, chiefly myocardial or pulmonary infarction or cerebrovascular accident The lesions most frequently responsible for death differed among the four groups studied

In view of the breadth of line with which the prototype of essential hypertension must be drawn proper evaluation of the efficacy of a therapeutic attempt of any sort would require a most carefully designed long term study of a very large number of patients

As pointed out earlier the difficulties of defining the natural history of essential hypertension are compounded by the awkward fact that we have no way of knowing what the pressure is except at intervals when we are measuring it Since it is well known that the circumstances surrounding the 'taking' of a blood pressure may enormously influence its height a clear picture of the importance of blood pressure in the natural history of essential hypertension must await the development of an instrument which will record the blood pressure throughout the 24 hour period

Relation to Stress

Of considerable interest in this connection is an observation reported by Freis in which a patient with malignant hypertension

prototype with real meaning It has not been found possible to draw such a prototype for essential hypertension despite general agreement among investigators as to age of onset, sex incidence, the nature of the hemodynamic disturbance, the symptoms and the ultimate pathologic findings The unpredictable feature is the course, the rate at which arterial and arteriolar lesions appear The relation between elevated arterial pressure and vascular degeneration has not been established, although there is a notable lack of morbid complications if high blood pressure begins after the age of 50 years This finding has moved Perera to suggest that hypertension beginning after the age of 50 not be included in the disease "essential hypertension" (32) He believes that the disease has its beginnings in youth, becomes established in the thirties, as a rule, and affects approximately 6 per cent of the population In a careful study of 300 patients, he found that the average time of survival was 20 years and that most of these years were spent without serious complications He observed a slight predominance of females and he found evidence of hypertension in the families of 30 per cent of his patients In Perera's series the height of the blood pressure bore little relation to the eventual outcome Although the findings of congestive failure, cerebrovascular accidents and retinal hemorrhages were generally unfavorable prognostic signs, there were numerous individual exceptions For example, some of his patients were alive 21 years after retinal hemorrhages were first recorded, 18 years after cerebral thrombosis, 12 years after the initial episode of congestive failure and 10 years after the beginnings of uremia

Among others who have attempted to define the natural history of essential hypertension, Griep and his co workers followed 117 hypertensive individuals for a period of 8 to 10 years (65) Ferris and his group studied 212 patients for more than 2 and an average of 4 years 141 of these had essential hypertension (141) Our own series of 114 patients is described in Chapter 8

In each report there is roughly a 60 40 predominance of females The estimated age of onset varies from 15 to 50 years with the peak distribution near 35 All agree on the most frequently associated symptoms and all agree that the symptoms have little to

CASE 2 *Lack of uniformity of cold pressor test in same individual on same day*

For example when one man a 28 year old steam fitter, thought that the decision as to whether or not he would undergo a mutilating sympathectomy hinged upon the outcome of a cold pressor test he displayed the response of a hyperreactor' Later the same day when he was reassured that the operation was not considered necessary, his blood pressure was lower initially and the test produced a 'hyporeactive response Even at times when his initial pressure was high however his response was hyporeactive when the performance of the test had no special significance for him (Figure 10)

Neither has the misnamed 'vasodilator' test in which Sodium Amytal is injected intravenously proved valid in appraisal of the hypertensive patient We have frequently observed intravenously administered Amytal to be followed by no reduction or even an increase in arterial pressure in individuals whose blood pressures fell markedly at times of emotional tranquillity Although there is evidence that Sodium Amytal may accentuate the hypotensive effects of acetyl beta methylcholine and the lowering of arterial pressure in postural hypotension (42) it appears to have no major

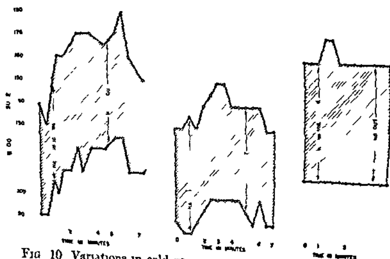


FIG 10 Variations in cold pressor response in a single patient The first two tests were done on the same day and the third a few weeks later

and levels of arterial blood pressure in the neighborhood of 250/160 was given antipressor drugs (33) During his stay in the hospital his blood pressure fell satisfactorily and after discharge he was continued on the same dosage of these drugs His wife, who was taking his blood pressure at home twice a day, reported readings near the normal range On each of three times when he presented himself for examination at the doctor's office, however, his blood pressure was up to its original height If such minor stress was capable of elevating his blood pressure against the depressor force of the drugs, it seems likely that it would be high during most of his day while meeting his usual problems and challenges, but there is no way to be sure In this connection it is interesting that hypertension has been observed to occur in a substantial number of patients with poliomyelitis who require treatment in a respirator (34) Whether it is connected with central anoxia or with the stressful circumstances of the disease has not been established, but the latter possibility is strengthened by the fact that an "epidemic" of hypertension followed the disastrous Texas City oil explosion (35) Ruskin and his associates reported diastolic hypertension over 95 mm Hg in 57 per cent of hospitalized blast victims Eight months later more than one third of these individuals still had hypertension (36)

The very earliest workers in hypertension recognized the relationship of the level of blood pressure to what was going on in the patient's life In an article published in 1920, O'Hare pointed out that troublesome life situations are capable of producing major changes in blood pressure and he suspected that they might be important in the genesis of hypertensive disease (41)

Efforts to make an appraisal of the reversibility of hypertension and prognosis on the basis of brief periods of observation have been seriously hampered by the fact that overriding stimuli arising out of the patient's life situation might or might not be operating at the time

Even the so called "standard" tests of blood pressure response are not valid indices of a prevailing hemodynamic state because the significance of the test often influences its effect on arterial pressure

mother and her father s death Blood pressure rose to 230/1.0 It fell to 180/120 when the conversation was turned to the possibility of happiness in the future Later she became very tense began to sob saying that her mother had killed her father by her bad treatment of him Blood pressure rose to 226/134 When the subject of her father s unhappiness was dwelt upon blood pressure rose to 238/150 When she was finally diverted and began to joke with the physicians blood pressure fell to 178/120

In numerous other hypertensive subjects the blood pre sure was made to rise or fall with appropriate stimulation under Sodium Amytal Often when the situation was manipulated, the blood pressure showed no initial drop following injection but began to climb at once as illustrated by the following patient

CASE 4 *Failure of intravenously administered Sodium Amytal to block pressor effect of stressful interview*

A 31 year old married woman had been known to have hypertension for approximately one and one half years She was a mild mannered, self possessed individual who denied all conflicts but whenever the fact that her sister had always been the more successful was dwelt upon her blood pressure rose Prior to injection of Sodium Amytal her blood pressure was 180/120 During injection of 0.3 grams of the drug she was asked to compare the achievements of her sister s husband with her own She smiled sweetly retained her composure and stated that her own husband had not done as well as her sister s But that doesn t bother me Well I did expect my husband to do better When I married him I thought I could make something of him but he treats us very well and it does not bother me at all By this time her blood pressure had risen to 215/135 After this topic had been dwelt on for five minutes she was reassured and allowed to rest Forty minutes later her blood pressure had fallen to 170/110 The course of the blood pressure during the interview is graphically shown in Figure 11

Headache Associated with Hypertension

As pointed out earlier headache is prominent among symptoms associated with hypertension but like the other symptoms its presence or ab ence is not very closely related to the height of the blood pre sure

pharmacodynamic effect on pressor mechanisms Like alcohol, i usually relaxes the individual unless he is concerned at the tim with seriously troublesome conflicts (43)

During interviews with fully conscious individuals who hav hypertension it has often been possible to alter the level of bloo pressure by alternately disturbing and reassuring the subject I was found that in subjects under the influence of Sodium Amyta such manipulations were far easier than they were when applied to unnarcotized individuals

The ease with which blood pressure could be modified in hy pertensive subjects after intravenous injection of Sodium Amytal is apparent in the following individual

CASE 3 *Correlation of blood pressure level with topic of discussion during an interview with hypertensive housewife*

A 41 year old married Jewess had hypertension since a pregnancy 10 years before The hypertension had been sustained at a level of approxi mately 210/130 for one and one half years prior to her visit to the New York Hospital She complained of frequently recurring headaches "like a tight hat" associated with irritability and fatigability Her conflicts concerned mainly her relationship with her parents and her husband Her mother had been strict and humorless, giving very little affection and support either to her husband or to her daughter Her father was also tense but kinder and more loving Both parents had hypertension The patient throughout her life had felt heavily dependent on her father and resentful of her mother, but she nevertheless continually felt the need to appease the latter and gain her approval She married at 24 a man four years older than herself upon whom she depended heavily as *she had on her father, but toward whom she also felt resentment* because of his relatively poor earning power Her general demeanor was one of cheerful self possession and none of her anxieties and conflicts were ap parent when she was in her fully conscious state

Sodium Amytal, 0 3 grams, was administered intravenously Before the injection blood pressure was 255/125 Under the influence of the drug she became well relaxed and began to talk freely Blood pressure fell to 170/110 When she recalled an experience in which she received a tele gram which she was reluctant to open because she feared that it might tell her of her husband s death, her blood pressure rose to 195/130 It subsequently fell to 180/120 She next mentioned her hatred for her

perhaps even prevents it The headache is increased in intensity by bodily effort, stooping over and coughing and closely resembles vascular headache of the migraine type (38)

A sudden elevation of blood pressure is actually capable of inducing a headache by itself, for example in pheochromocytoma or when epinephrine is injected directly into the blood stream Ordinarily however an elevation of blood pressure is not sufficient in itself to cause headache Indeed in association with a gradual elevation of blood pressure an actual constriction of the pain sensitive cerebral vessels occurs In view of the operation of La Place s Law, which relates the tension on the wall of a container to its inside diameter and the pressure within, unless the rise is steep it is usually necessary for the arteries to be dilated first before the pressure of blood within them is capable of distending the walls to the point of pain In essential hypertension the blood pre sure may contribute to the mechanism without being directly responsible for the headache For example when cranial arteries are already relatively relaxed, an increase in pressure within those arteries will make the occurrence of headache more likely It is helpful to recall that the hypertensive mechanism is as ociated with *arteriolar* narrowing and that the mechanism of vascular headache is *arterial* with distension of pain sensitive arteries

Approximately half the people who suffer from essential hypertension have troublesome headaches at one time or another throughout the course of their illness The occurrence of headache, however does not correlate with the level of the blood pressure In a given patient headaches may be encountered when blood pressure levels are not particularly high and later when blood pressure is sustained at a much higher level headaches may actually disappear Or the reverse may be true the headache occurring when the blood pressure is higher than usual Blood pressure is no higher among the half of the hypertensive patients who have headaches than among those who do not It would appear that patients who have headaches in association with high blood pressure are people who might be expected to have headache even without the high blood pressure In one large study nearly all patients with hypertensive headache were found to have

There are two types of headaches frequently associated with hypertension Neither bears a direct relationship to the level of the blood pressure One type, due to a sustained contraction of the skeletal muscles associated with ischemia has been studied (37, 142) The other is a *vascular headache*, dull, diffuse, deep aching, usually intermittent but occasionally continuous Such headaches characteristically throb, especially at the onset They may be generalized, unilateral, or occipital, and are commonly worse in the early hours of the morning, beginning at some time between midnight and 4 00 A M and reaching their peak intensity before daybreak or shortly before rising time They usually awaken the patient in the early hours of the morning and commonly diminish in intensity after he gets up, takes a cup of hot coffee and assumes the duties of the day Patients often discover after the onset of the headache that they are more comfortable in the sitting position, and a few have the notion that sleeping in the "head up" position minimizes the headache, and

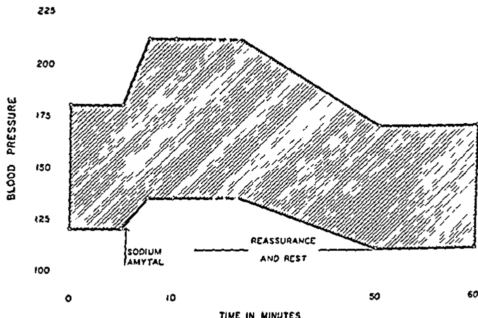


FIG 11 Prompt rise in blood pressure following the discussion of a stressful topic despite the simultaneous intravenous administration of Sodium Amytal

1904 by the neurosurgeon, Harvey Cushing One of the earliest instruments fell into the hands of Dr W W Keene of Philadelphia When one of Dr Keene's associates found that his chief's blood pressure was somewhat elevated, he advised him to let him examine his further "Not necessary," said Dr Keene "What I lack in capacity to regulate my blood pressure I make up in pertinacity Dr Keene lived to be 93 years old (40)

Summary

It is an old observation, and very easily confirmed that patients with essential hypertension, and normal subjects as well display an increase in arterial pressure when brought into certain situations involving threats to their personal security The pertinence of these responses to the initial causation or ultimate perpetuation of sustained arterial hypertension however, is not established The investigator who studies hypertension is handicapped by the lack of relationship between height of the blood pressure and the presence or absence of symptoms and the lack of uniformity and predictability of the natural course Some of the circumstances under which hypertension is observed have been reviewed, but it appeared more fruitful to focus attention on some of the underlying or associated hemodynamic adjustments which could be measured and recorded Since the ballistocardiograph was used in many of these observations a description of the instrument and of its range of usefulness and reliability seems indicated

been troubled with headache for years before their hypertension was discovered The headaches merely became more intense or changed in character and frequency after the high blood pressure had become established This is in keeping with the findings of Tunis and Wolff who observed that individuals who were not subject to vascular headaches showed very little day to day variation in amplitude of pulsation of branches of the temporal artery while headache sufferers showed marked lability in tracings from day to day in the absence of headache (39)

Extremely late in the course of hypertension or in malignant forms in which the kidneys have been irreparably damaged, there frequently occurs a highly troublesome and persistent headache of an entirely different mechanism In this condition, owing to the kidney's failure to remove waste products, tissues throughout the body become swollen and water logged Parts of the brain and other intracranial contents may participate in this process of swelling, thus displacing and pulling on pain sensitive blood vessel attachments much as brain tumors do Here again, it is not the height of the blood pressure which determines the presence or absence of headache, but rather the stress applied to the arterial wall

PATHOLOGY

Finally, it has not been established that any tissue damage is directly attributable to an elevation of arterial pressure It may be that hypertrophy of the left ventricle is due to the work which the heart must do to move the blood through the constricted arterioles, but the time relationship between the onset of elevated blood pressure and the beginning of cardiac hypertrophy is not clear At autopsy many of Perera's patients had hearts of normal size even after many years of hypertension One patient studied by one of the authors at University of Oklahoma Hospitals died with a cor bovinum weighing 700 grams two years after the onset of hypertension Neither does the height of blood pressure readings correlate very closely with the occurrence of left ventricular hypertrophy as emphasized by Hoobler

The sphygmomanometer was brought over to this country in

ferred to as either high or low frequency apparatus. A high frequency device is obtained if the moving part of the apparatus is relatively light and the spring restraining force distorted by its movements relatively strong. A heavy moving part and a weak spring result in low frequency.

The frictional forces responsible for stopping the oscillations of a cadaver displaced by a momentary force may be referred to as damping forces. In any oscillation system if the damping forces allow a prompt return of the displaced mass to its original position without permitting further oscillation the system is said to be critically damped. The damping of the human body is about one third of critical so that several oscillations follow a single momentary displacement.

It appears that the first ballistocardiograph was described by Gordon in 1877 (47). He noted the rhythmic swings of the indicators of weighing scales which occurred with the beat of the heart while subjects stood on them and recorded these motions. Later he recorded the movements of a rigid supporting framework suspended from the ceiling on which the subject lay supine (See A in Figure 12.) In 1905 Yandell Henderson devised an essentially similar apparatus, and suggested its use for estimating cardiac stroke volume (48). Because of the length of the supporting wires these devices had a low natural frequency.

Starr and associates were the first to use *the ballistocardiogram* extensively for clinical investigation. They modified the hanging table principle of Gordon and Henderson by opposing the table's motion with a strong steel spring braced against the wall. This virtually eliminated the motions of the table caused by the slow but powerful respiratory movements, so that it was not necessary for the subject to hold his breath. At the same time the motions of the table were made smaller so that greater amplification with a system of mirrors was necessary for adequate recording, and extraneous vibrations such as vibrations of the building, became more prominent though not a serious problem. The restraining force of the spring raised the natural frequency of the system to about 10 to 15 cycles per second depending on the amount of weight on the table.

CHAPTER VI

THE BALLISTOCARDIOGRAPH

THE ballistocardiograph records the motions of the body which occur with each beat of the heart Cardiac contraction initiates a complex linear and angular acceleration of blood in the ventricles and in the systemic and pulmonary arterial systems In keeping with Newton's third law of motion, the forces causing these changes in velocity and direction are accompanied by equal and opposite recoil forces, which are transmitted from the heart and great vessels to the body Because the mass of the body is much greater than that of the accelerated blood, the recoil forces cause only slight motion of the body (44)

It is customary and simplest to record those motions which occur along the long axis of the body when the subject is in the supine position Devices have been developed for recording with the subject standing or seated, but in general, they have no advantage over the supine method (45) Vectorballistocardiography, the study of the body's motion in various planes, is a promising field still in its infancy

It has been determined in fresh cadavers, placed on a firm surface, that the natural frequency of the human body is usually about six cycles per second (46) That is, if the body is displaced by a momentary force, it shakes back and forth at a rate of six times per second while coming to rest The frequency is lowered if the subject lies on a soft surface or if the legs are propped up so that there is less body area in contact with the surface

To minimize errors in the amplitude of the records, due to resonance effects, BCG apparatus is designed to have a natural frequency either greater or less than that of the body, and is re

the aorta, and partly, with apparatus which does not have added damping, of the body's overshoot The earlier waves, particularly I and J, are of the most interest, and are used in calculating stroke volume The formula used by Starr is as follows

$$SV = 7 \sqrt{(3I + 2J) \times A \times C}/2$$

Where I = The vertical depth of the I wave below the baseline

J = The vertical height of the J wave above the baseline

A = The aortic cross sectional area (estimated in each subject by reference to tables derived from anatomical data)

C = The cardiac cycle length in seconds

The numerical constants are values arrived at by complicated reasoning which is detailed in the original communication The formula presupposes that the BCG table is standardized so that a 280 gram force displaces the recording beam of light 1 centimeter In normal resting subjects this formula gave values for CO which correlated well with the ethyl iodide method (correlation coefficient of 0 86) The direction of change in CO shown by the Starr BCG after exercise or the administration of epinephrine or norepinephrine corresponds well to the Fick data but there are no comparative studies to define its quantitative accuracy under these conditions (143)

The BCG has many advantages in this application The record is made quickly there is little discomfort involved and multiple determinations in the same subject are easily made The basic principle behind such a use is a sound one namely that the recoil forces acting on the body bear a direct relationship to the amount of blood ejected by the ventricles Unfortunately, there are serious obstacles to developing a theoretically sound general formula for calculating stroke volume by this method Individual variation in the orientation of the heart in the size, shape, and elastic properties of the great vessels and in the mass and elast

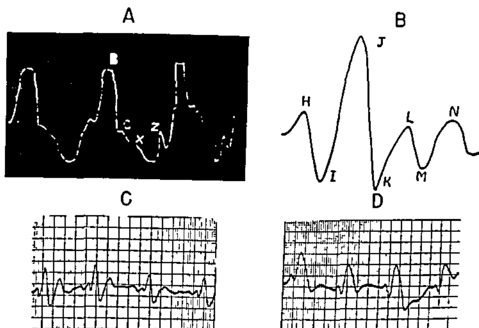


FIG 12 Various patterns of the ballistocardiogram A, Gordon (1877) B, Starr C, Dock D, Nickerson

Starr proposed that the various waves in the recorded complex be designated by letters in the middle of the alphabet A typical portion of a normal complex is shown schematically in B in Figure 12 The initial headward (H) and footward (I) waves are the result of forces occurring during systole The principal direction of the ejected blood is headward, causing a recoil force which acts footward (the downward I wave in the record) It is not certain why the upward H wave occurs It is probably partly the result of auricular contraction, accelerating blood footward into the ventricle with a recoil headward, because when auriculo ventricular dissociation is present, upward waves may occur after isolated auricular contractions However, a small H wave is sometimes seen when the auricles are fibrillating The J wave is believed to result from the angular acceleration of blood laterally into the lungs and footward around the aortic arch As the blood in the aorta is slowed by the resistance in the lower half of the body, the body is displaced footward, causing the K wave Subsequent waves (L, M, N, etc) are the result partly of reflected waves in

Because of the relatively small restraining force on the table, motions of the table are larger than with the Starr apparatus, and the low frequency minimizes the problem of building vibrations The principal disadvantage of the low frequency apparatus is that it responds readily to the slow but forceful respiratory movements In an apparatus of this design, the ballistic complexes are completely masked by the periodic oscillations of the table unless a damping mechanism is employed The Nickerson apparatus has an oil filled accordion like metal cylinder for this purpose interposed between the moving and stationary parts The resistance of the cylinder to compression and elongation can be critically adjusted before each determination In D in Figure 12 the greater distortion by respiratory movements the damping of waves late in the cardiac cycle and the slower response of the table are apparent The Nickerson apparatus has been used exclusively in the studies reported in this monograph

Nickerson and Curtis proposed a different formula for use with their low frequency apparatus In the formula *stroke volume* varies directly with the height of the IJ complex and the square root of the average blood pressure and inversely to the IJ interval and the height of the patient The force required to produce a given deflection of the table is readily determined by the use of a small weight acting over a pulley A simple form of the Nickerson formula assuming a paper speed of 25 mm /sec is given below

$$SV = 5\,02 \times \frac{S \times P}{SWH \times L}$$

Where S = The slope of the IJ complex (height/duration) (In practice, the mean of 10 slopes in sequential complexes during quiet respiration was used)

P = The square root of the blood pressure average (Systolic plus diastolic divided by 2)

SWH = The displacement in mm of the recording stylus caused by a 40 gm force applied horizontally to the loaded table

properties of the body affect the BCG It is impossible to be precise in weighing most of these factors It might be hoped that *quantitative estimations as to variations in SV* in the same individual could be made with assurance, but even within this limitation there are serious theoretical difficulties The capacity of the moving blood to move the body varies not only with its mass, but with its velocity Its velocity, in turn, depends on the amount of blood ejected into the closed system of large vessels, on the duration of systolic ejection, and on the cross sectional area of the vessels through which it passes Velocity will vary directly as SV if the last two variables do not change (49) However, simultaneous variation in systolic ejection time due to changing pulse rate or to changes in the physiologic state of the myocardium might even alter velocity in the opposite direction if *changes in SV were not large Similarly, changes in the arterial* pressure alter the cross section of the vessels and hence the velocity of the blood the degree of change in velocity depending in each individual on the elastic properties of the vessels and their original size For instance, in a subject in shock with a rapid pulse and *low blood pressure the high velocity due to rapid ejection and* small aortic cross section might actually cause high BCG waves, despite low SV

Such mechanisms were apparently operative when Cournand and associates found high IJ deflections and consequently high figures for stroke volume in some *subjects in shock while data* from cardiac catheterization indicated low stroke volume (50) The converse could also provide a source of error in calculations from the Starr instrument Thus a falsely low stroke volume would be indicated when the IJ wave was shortened by virtue of a relatively slow pulse and high aortic pressure

Low Frequency (Nickerson) Apparatus

Hoping to minimize extraneous waves and in the hope of getting a more precise determination of cardiac output, in 1944 Nickerson and Curtis described a *low frequency critically damped* apparatus (51, 52) It consists of a wooden table supported from below on metal straps It has a natural frequency of 1 5 cycles per second

ously If the plungers were struck with a padded mallet, so that ejection was abrupt and rapid the "BCG" had a form like that seen in normal living subjects Slower manual injection of the same volume of fluid caused low, distorted "BCG" complexes By variously altering the pattern of ejection they obtained "BCG" complexes which resembled closely various abnormal complexes found in living subjects with cardiac disease

In view of the fact that under most circumstances the force of ejection of blood from the heart depends chiefly on its mass the BCG record would be expected to reflect stroke volume Factors which alter the force of ventricular muscle contraction, however, as well as those of velocity and resistance already mentioned inevitably limit the BCG s reliability in this matter Data from cardiac catheterization and use of the Fick principle cannot, however serve as an adequate standard for comparison There are important sources of error in this technic as well which are concerned mainly with the need for a stable cardiodynamic situation when initial samples are drawn Richards has pointed out that in view of its inherent errors and the lack of stability of the heart and vessels especially under the dramatic circumstances of cardiac catheterization the Fick method becomes an imperfect check on the ballistocardiograph (56)

Portable Apparatus (Dock)

The simplest approach to the problem of recording the body's motions is that proposed by Dock and Taubman in 1947 (57) They described several ways in which the motions could be recorded directly from the body thus eliminating the need for a cumbersome movable supporting table The commonest such method in use at present uses the electric current generated when a wire coil moves through a magnetic field A wooden bar, containing a coil is placed across the shins A small permanent magnet is placed on the supporting surface, between the shins, so that it is near the coil As the shins move the coil moves in the magnetic field and current of appropriate direction and proportional to the velocity of motion, is generated This current is readily recorded by an EKG machine With suitable modifications of the electrical system the body s displacement or its acceleration can

L = Height of patient in cm

5 02 = A constant found by Nickerson and associates to give the best correlation with the Fick method estimations

Nickerson and associates made determinations of cardiac out put in the same normal resting subjects by both Fick and BCG methods within a few minutes of each other (53) Using the con stant 5 02 in the BCG formula, a correlation coefficient of 0 83 was obtained Other workers, using the Nickerson BCG, have found the correlation of resting values with Fick method values to be less satisfactory (54)

As to the reliability of the low frequency BCG in reflecting relative change, Nickerson and associates reported good corre lation, with the changes in CO calculated by the Fick method, in 5 patients recovering from shock (53) Cathcart and associates made simultaneous Fick and BCG determinations before, during, and after intravenous infusions of epinephrine, and found that though the direction of change in CO due to epinephrine was correctly shown by the BCG, the amount and proportion of change were not well shown (54)

More recently, Cardon and Lukas (55) found good directional correlation between Fick and BCG data following injection of norepinephrine and epinephrine and following exercise Fick meas urements made while the subject was lying on the BCG table and before, during and after immersion of the hand in cold water did not correlate closely with the calculations from the BCG It was, of course, not possible to take blood samples at precisely the same time as a BCG tracing The state of the circulation may not have been very steady between the two blood samplings for each Fick determination and there may have been other complicating fac tors

The great importance of velocity in determining the BCG form was shown by Starr and associates in experiments on fresh ca davers (49) Placing a cadaver on the BCG table, they simulated cardiac systole by rapidly injecting fluid into the origins of the aorta and pulmonary artery with large syringes The movement of the syringe plungers and the "BCG" were recorded simultane

The factor 1 332 is a constant which converts mm Hg to cm of water grams to dynes, and liters to cc The factor 60 converts CO per minute to CO per second

The uncertainty of the BCG as an index of direction of change in CO has been pointed out When BCG estimates of CO are used to evaluate direction of change in R, the uncertainty is compounded, because BP may change simultaneously For instance suppose a rise of 50 per cent in actual CO caused a 25 per cent rise in BP This would mean that R had dropped considerably But if the BCG estimate of CO indicated a rise of only 15 per cent in CO calculation would indicate a rise in R Though the BCG had correctly shown direction of change in CO, inferences drawn as to the behavior of the arterioles would be wrong

There is another factor which decreases the reliability of the Nickerson BCG to an extent which is impossible to define exactly The subject s respiratory movements move the table and distort some of the complexes The size of the complexes as previously noted are affected by the phase of respiration, so that differences as great as 100 per cent in the IJ slopes may occur within the period of a quiet respiratory cycle These changes are related both to actual variations in stroke volume due to pressure changes within the thorax and to the position of the respiratory bellows mechanism The original practice was to have the subject hold his breath in mid inspiration throughout the taking of a record However in practice it is difficult to cease respiration at the same phase of the cycle each time and in stress experiments distraction of the subject by conscious attention to such details must be minimized The present practice is to allow the subject to breathe quietly and to determine the slopes of at least 10 sequential complexes using the mean of these values for the factor S in the formula Under resting conditions except in obese subjects all slopes are usually readable but under conditions of stress, increased rate and depth of respiration and other body motions may render the majority of complexes unreadable

In the following studies on hemodynamic reactions during stress the BCG has been used extensively because of the ease with which multiple rapid painless determinations can be made

also be recorded directly Apparatus of this type, being light, has a high natural frequency Such devices have the advantage of being portable and simple, but cannot be readily standardized for quantitative work A typical tracing is shown in C of Figure 12

When apparatus of the Dock type is used, normal BCG records increase in amplitude after exercise Funkenstein and associates state that this also occurs after epinephrine administration but not after norepinephrine administration (58) As with the Starr and Nickerson apparatus, the cardiovascular effects of the two naturally occurring sympathetic humoral substances can thus be distinguished from each other

PERIPHERAL RESISTANCE

When mean blood pressure (MBP) and CO have been estimated, total peripheral resistance (R) can be calculated using the relationship

$$\text{Resistance} = \frac{\text{Pressure}}{\text{Flow}}$$

For practical purposes, this can be regarded as the resistances offered by the arterioles of the body Obviously such a calculation gives no information as to the relative contribution to the total resistance of various portions of the arteriolar bed Localized vasoconstriction may occur undetected by such a calculation if vasodilatation has occurred in the majority of arterioles

Resistance is customarily expressed in either of two ways

$$\text{as "Units"} = \frac{\text{MBP}}{\text{Cardiac Index}}$$

or in absolute units

$$\text{R dynes sec cm}^{-5} = \frac{\text{MPB dynes cm}^{-2}}{\text{CO cm}^{3}\text{ sec}^{-1}}$$

Absolute units of R are calculated by the formula

$$R = \frac{\text{MBP mm Hg} \times 1\,332 \times 60}{\text{CO L/min}}$$

per cent, respectively All subjects were laboratory personnel familiar with the apparatus and the experimenters It is of interest that the larger variations in the series occurred in 2 young female subjects (standard deviations CO of 62 and 52 L/min), while 2 of the experimenters themselves had standard deviations of CO of only 14 and 16 L/min One subject not included in the series, under deep Amytal narcosis, had a standard deviation of CO of 13 L/min In any case, the variation observed is small enough to make most of the changes observed during stress significant and probably even the differences observed in the "control' studies are partly due to actual changes in hemodynamics occurring either spontaneously or in response to stimuli during the experimental procedure

SUMMARY

Ballistocardiography as a convenient if inexact indicator of cardiovascular dynamics has been reviewed It is pointed out that the method lends itself to prolonged and frequently repeated observation in a single subject and that the data thus obtained are satisfactorily reproducible Alterations in the pattern under stress have been shown to correspond to or to combine the characteristics of the changes induced by subcutaneous injection with epinephrine on the one hand (increased cardiac output and reduced peripheral resistance) or with norepinephrine on the other (increased peripheral resistance and reduced cardiac output) In interpreting the data however no inferences are made concerning actual cardiac output or peripheral resistance but rather the terms are used to indicate the characteristic and readily studied changes in the ballistocardiographic tracing

while the subject is reclining comfortably and is free to talk "Stroke volume," "cardiac output" and "peripheral resistance" have been calculated according to the Nickerson formula, and the patterns of change compared to the changes induced by nor epinephrine or epinephrine The differences in BCG patterns induced by stressful situations are certainly not artifacts, but conclusions as to the nature of the underlying hemodynamic changes must remain tentative

Procedure

The apparatus is one similar to that of Nickerson The supporting metal straps are of constant length When loaded with 94 kg of dead weight the table has a natural frequency of 1 7 cycles per second Motions of the table are transmitted by a rigid coupling to a flexible plate, to which four strain gauges are cemented The strain gauges constitute the variable resistances in a Wheatstone bridge circuit, so that distortion of the plate releases a current which varies with the direction and amount of distortion

Before a determination is made, the apparatus, loaded with 94 kg of sandbags is adjusted for critical damping The displacement of the recording stylus by a 40 gram force is determined The subject then lies on the table, after an equal weight of sandbags have been removed, with his feet against a vertical footboard He is allowed to breathe quietly throughout the procedure Brachial arterial pressure is determined by the auscultatory method immediately before and after each recording The method of calculation has already been given

Reproducibility of the Method

The reproducibility of the method was determined as follows Serial determinations were made in resting subjects without cardiovascular disease at intervals of 30 seconds to 1 minute One hundred and two determinations were made on 7 separate subjects The calculated values were adjusted proportionately around common means of 72 cc SV and 5 5 L/min CO

The standard deviations of the group are 3 79 cc SV and 385 L/min CO, with coefficients of variation of 5 3 per cent and 7

arterial pressure to the height of the IJ wave, three contrasting patterns of cardiovascular dynamics were evoked by various stimuli including muscular effort, immersing the hand in cold water or interviews concerning pertinent personal problems

Hypodynamic Reaction Pattern

The first pattern described in 1946 by George Wolf and Wolff was called the hypodynamic response (61) It was characterized by a fall in blood pressure and a decrease in height of the IJ wave Under these circumstances calculated values for both cardiac output and peripheral resistance were low This pattern was the least frequently encountered but when pronounced was the one associated with the most distressing symptoms

CASE 1. *Hypodynamic reaction in a young man with chronic asthma*

A striking example of this type of reaction was a 32 year-old patient with bronchial asthma who developed hypotension and if he was in the standing or sitting position fainted every time his hand was immersed in cold water Whenever his hand was immersed while he was reclining, his blood pressure fell from the neighborhood of 120/80 to the neighborhood of 90/60 displaying a cold depressor instead of the usual cold pressor effect This patient had no detectable cardiovascular abnormality Neither did he have an unduly sensitive carotid sinus to digital pressure

CASE 2. *Hypodynamic reaction in a usually hypertensive woman under circumstances of feeling overwhelmed*

Such hypodynamic responses were also occasionally encountered among hypertensive subjects as exemplified by a 48 year-old married Jewess whose chief conflicts concerned the unsalutary relationship between her husband and her *older son* *The former* had not wanted children and considered the patient s open adulation for and extremely protective attitude toward their son a direct threat to his security Consequently he punished the boy at every opportunity The patient s hypertension was discovered at the time when her son was drafted into the Army It persisted during the subsequent period until the news came that the boy was to be sent overseas She *felt overwhelmed* and defeated by this prospect and continued dejected with much lower blood pressure until her resentment was again aroused by conflict between her husband and son and with that her blood pressure rose again to hypertensive levels

CHAPTER VII

MEASUREMENTS OF HEMODYNAMICS IN ESSENTIAL HYPERTENSION

As INDICATED in the foregoing chapter, the ballistocardiogram reflects the dynamics of heart action as they are modified by the table on which the subject lies and by the weight and contours of the individual studied. Thus, ballistocardiographic records cannot be compared with full satisfaction from person to person. But records taken on the same individual, on the same ballistocardiographic table, and under the same circumstances are quite comparable. The waves of the ballistocardiogram which reflect force and velocity and volume of blood ejected bear some relationship to cardiac output, but they have not correlated with sufficient predictability with more generally accepted methods of measuring cardiac output to warrant any quantitative inferences. Using the height and slope of the IJ wave, however, and fitting it into Nickerson's formulae for cardiac output, it is possible to recognize certain dynamic patterns of cardiac function which are seen with frequency and predictability under a given set of circumstances.

In our laboratory approximately 1400 tracings have been made on 150 subjects including subjects with a variety of cardiovascular disturbances and normal subjects (59, 60). The studies were done with the subject reclining on the ballistocardiographic table. Records were made during quiet breathing for several seconds out of every minute. Immediately before and after each record the arterial pressure was determined by means of a sphygmomanometer cuff wrapped around the left arm. The mean of these readings was used in the calculations. With reference to the relation of

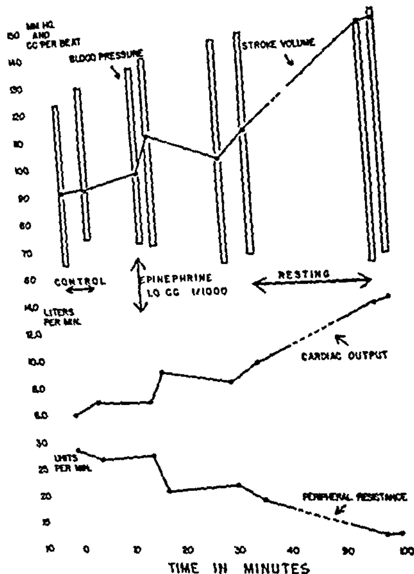


FIG 14 The hemodynamic pattern induced by subcutaneous administration of epinephrine as recorded by the ballistocardiograph

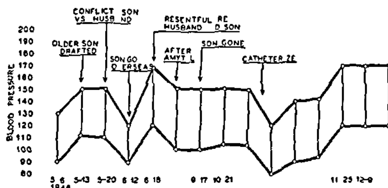


FIG 13 Episodes of lowered blood pressure associated with feelings of defeat in response to overwhelming events occurring in a subject with essential hypertension who reacted to most stresses with more aggressive feelings and elevation of blood pressure

Later, at a time when the patient was catheterized, a procedure to which she reacted with overwhelming shame, she again displayed a precipitous transitory fall in blood pressure with sweating and tachycardia, as shown in Figure 13 This observation has been repeated on three separate occasions preparing her for catheterization, but with no actual instrumentation with similar results each time

Much more frequently seen were pressor responses associated with stressful interviews and experiences among hypertensive patients Although, as already pointed out, it was not possible to draw quantitative inferences regarding the underlying hemodynamic effects responsible for the pressor reactions it was possible to establish a pharmacodynamic parallel for the two contrasting ballistocardiographic patterns seen

One of the ballistocardiographic patterns evoked by interviews had precisely the characteristics of the pattern seen after subcutaneous injection of epinephrine The prototype of the "high output" or epinephrine response is shown in Figure 14 It resembles closely the response to exercise When measurements of cardiac output have been made using cardiac catheterization and the application of the Fick principle, both epinephrine and exercise have been shown to produce an increase in stroke volume and a reduction in peripheral resistance Calculations from the ballistocardiogram correspond consistently with this pattern When, in

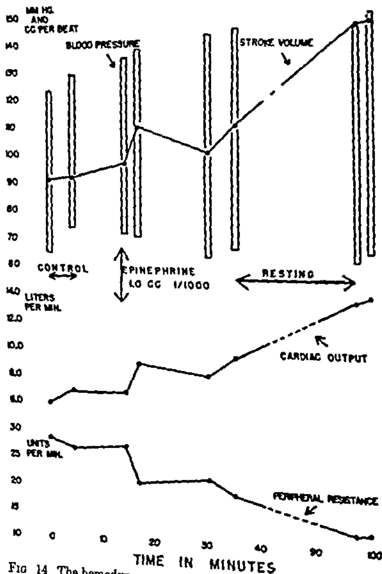


FIG 14 The hemodynamic pattern induced by subcutaneous administration of epinephrine as recorded by the ballistocardiograph

our studies, such a pattern has been observed following the stimulus of an interview we have referred to it as a "high output" pattern The figures from Nickerson's formula have been used for convenience in charting but no quantitative inferences are drawn from the ballistocardiographic pattern with reference to cardiac output

The other ballistocardiographic pattern induced by interviews had all the characteristics of that following subcutaneous injection of norepinephrine, a circumstance known to produce a pressor response attributable to an increase in peripheral resistance Hence we have called it the "high resistance" pattern The prototype of the norepinephrine or "high resistance" pattern is shown in Figure 15 When pressor responses occurred with ballistocardiographic evidence of an increase in both "output" and "resistance" the term mixed pattern has been used

"High Output" Pattern

The epinephrine like exercise, or "high output" pattern of vascular response was that characterized by an elevation of blood pressure with increase in the height of the IJ deflection on the ballistocardiograph, resulting in a calculated increase in the cardiac output, usually with a fall in the calculated peripheral resistance As described in Chapter II, this was not only the characteristic hemodynamic response to exercise but also to the mere contemplation or anticipation of exercise

The occurrence of a physiological response to a symbolic stimulus is familiar in the case of salivary flow in anticipation of eating Therefore, it was not surprising that a hyperdynamic hemodynamic response occurred in anticipation of exercise It was of special interest, however, that this same type of hyperdynamic response occurred under circumstances of stress in which there was no consideration of exercise If this change indicated an actual associated increase in output of the heart, which it appears to do there must be a resulting increase in peripheral blood flow, a situation which obtains more or less continuously in hyperthyroidism but apparently only intermittently and for short

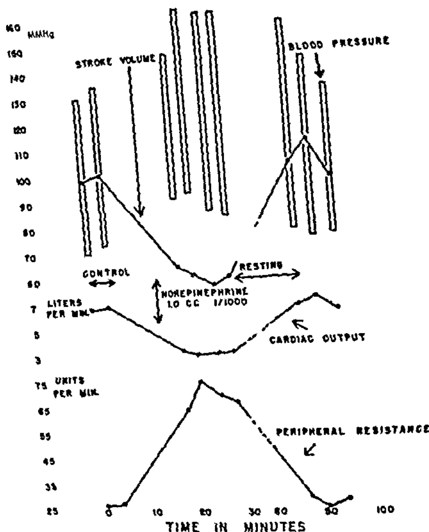


Fig 15 The hemodynamic pattern induced by subcutaneous administration of norepinephrine as recorded by the ballistocardiograph

periods of time in individuals with normal metabolism During stressful interviews this type of cardiovascular response was most commonly encountered when anxiety and conflict were largely overt and easily recognizable

CASE 6 *A 46 year-old woman with overt anxiety and a "high output" type of hemodynamic response to interview but a variable reaction to the cold pressor test*

The patient, an unmarried clerical worker and stenographer, was short, dark, neatly dressed and slightly obese Her manner was intense, restless and volatile Hypertension had been discovered 10 years before as an incidental finding when she was being studied because of amenorrhea There had been no signs or symptoms of cardiac, renal or central nervous system involvement Her blood pressure was 198/118 There was moderate narrowing of the arterioles in the optic fundi Although the radiographic shadow of the heart was of normal size, there was moderate left deviation of the electrical axis in the electrocardiogram Urine was negative, blood urea nitrogen 15 mg per cent, and urea clearance 76 9 per cent and 92 6 per cent

The patient was seen 73 times in two and one half years at somewhat irregular intervals

She was the fourth of six mixed siblings, the two oldest children died in infancy or early childhood A brother, one year older, is living and well, and a sister, four and one half years younger, is living and well A sister, three years younger, died of leukemia when the patient was 5

The patient was born in Russia but moved to this country when she was 1 year old Her father, who came from a scholarly Russian-Jewish family, was described by the patient as a 'genius " She considered him charming brilliant, scholarly and affectionate, but also unpredictable, domineering and self centered He came to the United States in 1904, while his wife was pregant with the patient "He was a great lover of beauty and I was the beauty in the family " He habitually showered the patient with expensive gifts, yet frequently abused her and the rest of the family with physical beatings He made a financial success in a partnership with a wholesale vegetable commission merchant but died at the age of 46 of coronary occlusion associated with hypertension when the patient was 16

The mother's parents were relatively untutored Her father was an orphan who became a well to do merchant The mother was described by the patient as a cold woman who "didn't believe in love " She apparently had very little regard for her husband and was frequently heard to say, "Just as there is no such thing as a good dog there is no such thing as a good man " From her the patient seemed to acquire a feeling of being stupid, worthless and a great disappointment to both parents The patient considered her mother to be unduly selfish, tyrannical and

suspicious Nevertheless she became her mother's closest companion until, having had hypertension for many years, the mother ultimately developed a hemiparesis She was treated in a nursing home for two years and then lived with her younger daughter until she died Throughout this period she abused the patient for having neglected her

The patient's birth was normal She was a healthy breast fed infant Throughout her childhood she felt completely overshadowed by her younger sister who was quick bright, argumentative, stubborn and domineering

She was an average student in school sweet tempered and compliant and never showed her anger

When her father died her mother was overwhelmed by the prospect of financial responsibility Neither she nor the older brother were willing to undertake the settlement of the father's estate Thus, the burden fell to the patient who had little success and ultimately the family lost substantially all of the father s holdings She was frequently accused by the mother and an aunt of having been responsible for her father s death

She became withdrawn and moody, developed amenorrhea, lost her appetite and had difficulty in swallowing This led to a tonsillectomy and a trip to the country for convalescence Here at the age of 17 she fell in love with a young man who soon jilted her

Back in the city she worked as a secretary for an eccentric bachelor, who made unwelcome advances to her Later however, when another secretary fell in love with the boss an antagonism developed which culminated in a violent quarrel in which the boss seemed to take the other woman s side The patient resigned and did not work again for the next 10 years She lost her former placid and poised manner and became increasingly irritable and even assertive toward her mother and younger sister Finally in 1941 some of the arguments became so violent that both mother and sister threatened to have the patient committed to a mental institution During this period she had frequent nausea, epigastric fullness belching fullness in the head weakness jitteryness frequent flushing headache tachycardia and constipation She consulted many physicians and at one time was treated for hyperthyroidism although the diagnosis was not confirmed

Following an unsuccessful period of psychotherapy and an attempt to find help in the Quaker faith she became convinced that her symptoms arose from her being consumed with hatred Accordingly she tried diligently to regain the sweet tempered behavior she had displayed when her father was alive About one year later her hypertension was discovered

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Thereupon, feeling that her home life was making her ill, she impulsively left and took a furnished room in New York City Refusing financial help from her sister or her mother she supported herself by doing secretarial work at a Salvation Army Shelter

After that she held many jobs, most of them involving typing social work records or psychiatric histories In each of these jobs, when first employed, she was well liked, well thought of, made friends quickly and got along well Shortly, however, there developed an antagonism, usually toward that person with whom she had first felt closest She felt increasingly that she was being imposed upon until there occurred a single violent outburst of recrimination and then resignation

Symptoms of fatigue, muscular aches and pains, headache, mild indigestion and constipation continued during this period She lived either at women's hotels, in a room by herself or had living accommodations on the premises of various institutions She was never able to make lasting friendships with either men or women She states that she never fell in love after the original blighted romance when she was 17 years old She remained a virgin

Life became a constant struggle "to keep afloat" She felt that the threat of a major depression was continually hanging over her and that if it should recur she would surely need hospitalization She was aware of a desperate need for love and acceptance but was completely unable to find a way to get it Outside interests and creativity were almost completely lacking Recreation consisted principally of going to the motion pictures with some casual female acquaintance

She had recently lost a secretarial job at the time when first seen in the clinic and was concerned that she might be slipping into a depression At first the patient responded well in the clinic She got a new job and there was an improvement in symptoms She became increasingly able to express resentment and to "stand up" to people over minor differences without fearing that she would alienate them permanently Within approximately a year, however her mother had a second cerebrovascular accident and soon died Her mother's death aroused a good deal of uneasiness and guilt in the patient She lost another job and in discouragement returned to the maternal household to live with her sister She referred to this move as "returning to the scene of the crime" Three weeks later she developed a full feeling in the head and numbness of the left arm and leg, with a feeling of clumsiness

Neurological examination yielded no evidence of abnormality except for dysaesthesia in the left leg and a positive Hoffman reflex on the left

There were 12 interviews while the patient was on the BCG table During the interviews she usually expressed herself freely, was seldom guarded and evasive and usually showed objective manifestations of being disturbed by the interview, including weeping and flushing Except for the first study the pattern of response to stressful interviews was uniformly that of an increase in stroke volume with fall in 'resistance regardless of the type of material discussed or of efforts by the investigator to alter his attitude and behavior during the studies An example of these changes is shown in Figure 16

During most of the interviews her attitude was tense and querulous, not hostile but generally ingratiating On one occasion she displayed a burst of rage while lying on the BCG table There occurred a brisk hemodynamic reaction characterized by a marked rise in stroke volume and fall in peripheral resistance as shown in Figure 17

It is of interest that despite the monotonous regularity of the stress interview patterns the response to the cold pressor test was variable in

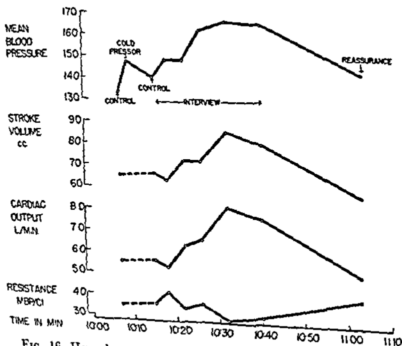


FIG 16 Hemodynamic reaction to cold pressor test and to stressful interview in a 46-year-old woman

Thereupon, feeling that her home life was making her ill, she impulsively left and took a furnished room in New York City Refusing financial help from her sister or her mother she supported herself by doing secretarial work at a Salvation Army Shelter

After that she held many jobs, most of them involving typing social work records or psychiatric histories In each of these jobs, when first employed, she was well liked, well thought of, made friends quickly and got along well Shortly, however, *there developed an antagonism*, usually toward that person with whom she had first felt closest She felt increasingly that she was being imposed upon until there occurred a single violent outburst of recrimination and then resignation

Symptoms of fatigue, muscular aches and pains, headache, mild indigestion and constipation continued during this period She lived either at women's hotels, in a room by herself or had living accommodations on the premises of various institutions She was never able to make lasting friendships with either men or women She states that she never fell in love after the original blighted romance when she was 17 years old She remained a virgin

Life became a constant struggle "to keep afloat" She felt that the threat of a major depression was continually hanging over her and that if it should recur she would surely need hospitalization She was aware of a desperate need for love and acceptance but was completely unable to find a way to get it Outside interests and creativity were almost completely lacking Recreation consisted principally of going to the motion pictures with some casual female acquaintance

She had recently lost a secretarial job at the time when first seen in the clinic and was concerned that she might be slipping into a depression At first the patient responded well in the clinic She got a new job and there was an improvement in symptoms She became increasingly able to express resentment and to "stand up" to people over minor differences without fearing that she would alienate them permanently Within approximately a year however her mother had a second cerebrovascular accident and soon died Her mother's death aroused a good deal of uneasiness and guilt in the patient She lost another job and in discouragement returned to the maternal household to live with her sister She referred to this move as "returning to the scene of the crime" Three weeks later she developed a full feeling in the head and numbness of the left arm and leg, with a feeling of clumsiness

Neurological examination yielded no evidence of abnormality except for dysaesthesia in the left leg and a positive Hoffman reflex on the left

CASE 7 *High resistance type of response to a stressful interview with a restrained superficially composed hypertensive woman*

A 30-year-old unmarried woman first came to the clinic in 1946 complaining of headaches and easy fatigability Hypertension had been discovered two years before Her blood pressure was usually in the neighborhood of 200/110 During the experimental procedure she lay quietly, smiled frequently and seemed composed even during a discussion of her relations with her mother, toward whom she felt intense hostility An underlying truculence was evident in her attitude, however, as manifested by the laconic reply or ironic understatement During the period of interview her blood pressure rose briskly a rise associated with a marked increase in peripheral resistance but none in the stroke volume The course of events is shown graphically in Figure 18

CASE 8 *High resistance' type of response associated with denial of emotional disturbance*

A second patient was a 30 year old unmarried secretarial worker who was first seen at the New York Hospital in November 1951

She had been well until 1944 when following an attack of acute cholecystitis a gangrenous gall bladder was removed Her blood pressure was normal at that time

She had been the fifth of seven mixed siblings and she was seven years younger than the next older When she was 7 her mother was found to have diabetes Two years later she began to require insulin Because she disliked giving herself injections her physician suggested that our patient administer the insulin

Acting on that single injunction the nine year old girl faithfully gave her mother insulin twice a day During the next 14 years the only interruption occurred when her mother was in the hospital undergoing a cholecystectomy when the patient was 15 Later, when the patient herself had a cholecystectomy she demanded a discharge before her sutures were removed so that she could care for her mother A few days later at night she heard her mother call This was not unusual, in fact, for years the patient had been jumping out of bed if her mother was thirsty or had a cough or was restless Nevertheless she jumped up so fast that she tore open her incision As she entered her mother s room she found her dying in acute pulmonary edema Her last words were, Take care of the family and make sure the youngest boy graduates from college

Four months after her mother s death a sudden attack of nausea and

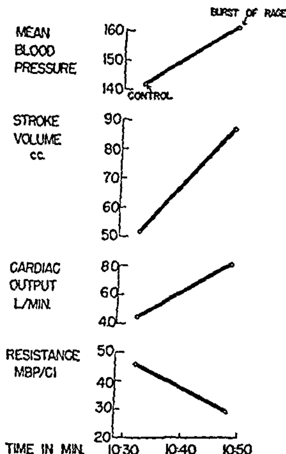


FIG 17 Sudden increase in "stroke volume" with a reduction in "peripheral resistance" associated with a pressor response during a burst of rage

this subject, "high output," "high resistance" and mixed patterns being observed on three different occasions

"High Resistance" Pattern

Under circumstances of suppressed or repressed anger, resentment or anxiety, a third type of hemodynamic reaction was characteristically encountered It was marked by an increase in arterial blood pressure without an increase in the height of the IJ wave on the ballistocardiogram and often with a decrease in height Therefore, the calculated 'cardiac output" was relatively low and the "peripheral resistance" high

vomiting led to the removal of a gangrenous appendix Blood pressure at this time was said to be 180 '

Because of her mother s dying request the patient put aside her plans for marriage

She went to work to earn money enough to send her younger brother through college Given the nickname Smiley ' at work she was effective well liked and highly respected She always insisted that she had been happy to do her duty by her family in this way, that he had never felt sorry for herself or angry that she had not been able to marry She cooked for and looked after her father until his death in 1951 Shortly thereafter and following a massive hemoptysis she developed exertional dyspnea orthopnea and finally attacks of paroxysmal nocturnal dyspnea At this time blood pressure ranged between 280/170 and 230/138 Pulse was 120 The ocular fundi showed grade I vascular changes chest was clear but the heart was moderately enlarged to percussion and the liver was palpable and tender The electrocardiogram showed left deviation of the electrical axis and chest X ray indicated generalized cardiac enlargement The urine test for protein was 2+, blood urea nitrogen 11 mg per cent, urea clearance 63 2 per cent and 62 6 per cent Intravenous pyelogram was normal

Following an injection of benzodioxane there was a sharp rise in her blood pressure and an increase in her symptoms of congestive failure Tense and exhausted she was admitted to the hospital After a brief sleep she was awakened by an intern who insisted upon taking a lengthy history and doing a physical examination although she had been thoroughly examined in the clinic a few days before She became intensely angry and spoke out with unaccustomed vituperation A few days later an experimental interview was undertaken while she was reclining on the ballistocardiograph table After a suitable control period the matter of her temper outburst was abruptly introduced Although she expressed resentment at the treatment she had received she denied that the episode had upset her in the least During the denial an increase of 40 mm in mean blood pressure was recorded The pressor response was associated with a fall in calculated stroke volume ' and with a rise in peripheral resistance

This latter type of hyperdynamic response would be expected to increase the work of the heart without increasing peripheral blood flow since blood flow depends more or less directly on cardiac output The characteristic situation under which this

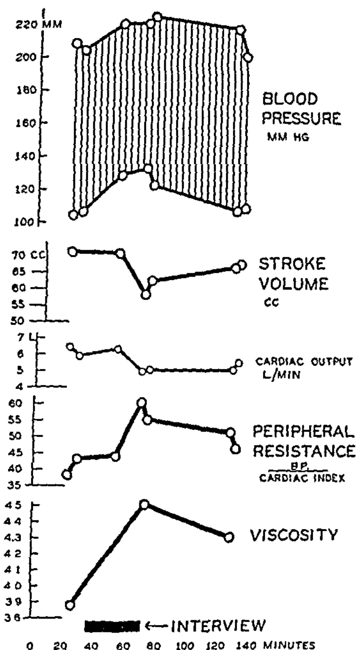


FIG 18 Hemodynamic reaction during stressful interview Simultaneous measurements showed an increase in blood viscosity associated with pressor response

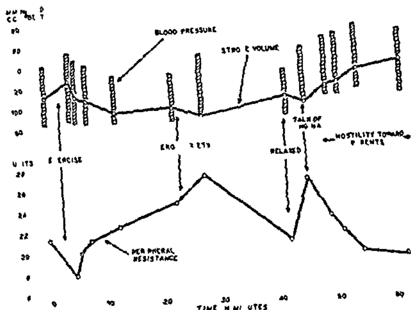


FIG 19 Varying patterns of hemodynamic reaction associated with pressor responses during a stressful interview

"peripheral resistance" fell while "cardiac output" rose correspondingly The course of events is shown graphically in Figure 19

In an attempt to define the circumstances under which each of the various patterns occurred 136 stressful interviews were carried out on 108 subjects while they were lying on the ballistocardiograph table 69 were hypertensive individuals and 39 normotensive Under the circumstances of the laboratory procedure there was a slight overlap of the height of resting blood pressure between the two groups In 7 of the hypertensive and 10 of the normotensive subjects the average mean blood pressure during the interview was no higher or was lower than the average resting mean blood pressure Although a larger proportion of the normotensive subjects did not exhibit an elevation of blood pressure during the interview the difference between the two groups is not statistically significant (p > .05)

Data from the 62 hypertensive and 29 normotensive subjects

type of response was predictably observed among normal subjects was during blood letting from transfusion donors

In some patients either type of hemodynamic response was observed with resulting elevations of blood pressure due to increase in "peripheral resistance" at one time and increase in "stroke volume" and "cardiac output" at another

CASE 9 *Alternating "high output" and "high resistance" type responses associated with varying patterns of emotional reaction during interview*

The patient was a 38 year old white man in whom blood pressure readings over a 14 year period had frequently revealed a diastolic over 100 mm Hg As a child the patient had been very aggressive and quick tempered He fought frequently with an older brother and the death of a younger sibling, aged a year and a half when the patient was 5, was jokingly attributed by the family to the beatings inflicted on the infant by the patient He was able to remember virtually nothing of his mother who died when he was 12 years of age Following her death his general demeanor changed radically No longer bellicose he developed a soft spoken manner and a calm outward appearance His hypertension was first noted at the age of 23 and has fluctuated considerably at and above normal levels since that time The patient's father had had angina for several years before his sudden death in 1939

Recently, the patient had been told that his complaint of diffuse chest and axillary pain suggested angina pectoris and that an electrocardiogram was indicated During the experimental observation while preparations were being made to take an electrocardiogram, the patient's blood pressure rose briskly with an associated sharp increase in "peripheral resistance" His manner at the time was tense but poised and compliant After the electrocardiogram had been taken the patient was reassured and as he became more relaxed blood pressure level fell with an accompanying decrease in 'peripheral resistance' Later when the topic of angina pectoris was abruptly introduced into the discussion, blood pressure rose again and again there was a sharp elevation of "peripheral resistance" His manner at this time became deliberate almost judicial Words were carefully selected There was evident tension and restraint but no obvious show of emotion A few moments later, during a discussion of hostility toward his parents, in which he displayed evident feeling, the blood pressure remained elevated but

TABLE I

Pressor response and hemodynamic pattern during stressful interview among hypertensive and normotensive subjects

Number Lett	S	Age	Mean Resting Blood Pressure†	Δ Blood Pressure†	Δ Blood Pressure %	Pattern
			I Hypertensives			
2	M	29	108	4	4	Resistance'
6	F	47	1)132	23	17	Mixed
			2)151	16	12	Output
			3)142	20	14	Output
			4)136	21	15	Output
			5)136	21	15	Output
			6)134	12	9	Output
			7)147	22	15	Output
			8)158	6	4	Output
			9)14	19	13	Output
			10)133	20	15	Output
			11)145	10	7	Output
			12)144	13	9	Output
8	F	27	125	20	16	Mixed
9	M	39	102	21	21	Output
12	M	42	133	12	9	Mixed
13	F	38	127	18	14	Resistance
16	M	27	103	7	7	Resistance
18	F	48	120	30	25	Mixed
21	M	24	101	10	10	Mixed
28	M	53	1)108	16	15	Resistance
			2)125	12	10	Mixed
29	M	48	104	29	28	Resistance
30	F	37	120	1	1	Output
34	F	61	140	32	21	Resistance
35	F	43	136	12	9	Output
36	F	39	190	25	13	Output
37	M	40	112	24	21	Output
41	F	42	144	25	17	Output
43	M	40	138	1	1	Resistance
45	F	37	131	28	21	Output
46	F	37	128	24	19	Resistance
49	F	46	118	25	21	Resistance
51	F	47	146	44	30	Output
54	F	56	123	18	15	Mixed
55	M	27	1)137	7	5	Resistance'
			2)133	19	14	Mixed
56	M	47	160	7	4	Resistance

whose blood pressure rose during the interview are summarized in Table 1. In the hypertensive group, the average rise in blood pressure was 18.09 mm Hg ± 9.19, and in the normotensive group 10.76 mm Hg ± 6.11. The difference is statistically significant (p < .01). However, average *percentage* rise in blood pressure was 13.98 ± 7.16 and 11.97 ± 7.08, respectively, and the difference between the two groups is not significant. There was no significant difference, moreover, among the hypertensive and normotensive group with reference to the occurrence of "high output," "high resistance," or "mixed" patterns. In both groups, half of the subjects responded with the "output" pattern, a quarter with the "high resistance" pattern, and a quarter with the "mixed" pattern.

Among the hypertensive subjects, a statistical analysis failed to show any significant correlation of the various patterns with age and sex of the patient, severity of the hypertensive disease process according to the criteria of Palmer and associates (62), the duration of known hypertension, the height of the resting blood pressure, or the percentage change of blood pressure during interview. There did, however appear to be an association between the hemodynamic pattern underlying a pressor response and the relative freedom with which the patient expressed his feelings during interview. "High output" patterns predominated when objective signs of emotional disturbance were evident, such as weeping, flushing, or tachycardia and when, according to the interviewer's impression, the subject seemed to be expressing himself relatively frankly and freely. "High resistance" or mixed patterns were more often encountered when there were no overt signs of distress and when the interviewer had the impression of suppression, repression, or evasiveness in his subject.

In view of the fact that a variable type of hemodynamic reaction was frequently seen with rapidly changing pattern within a matter of seconds, it seemed possible that the reported failure of correspondence between the Fick and the ballistocardiographic measurements may be in part due to inability to synchronize the observations precisely.

It was striking that the type of ballistocardiographic record ob-

Table I—*continued*

Number or Letter	Sex	Age	Mean Resting Blood Pressure†	Δ Blood Pressure†	Δ Blood Pressure %	Pattern
Z	F	35	94	25	27	Mixed
AA	F	40	118	13	11	Output'
BB	F	38	117	25	21	Output'
Mean		41 7	131 5	18 09 ± 9 19	13 97 ± 7 16	

Patterns (first interviews only) O = 30 R = 17, M = 15

II Normotensives

Number or Letter	Sex	Age	Mean Resting Blood Pressure†	Δ Blood Pressure†	Δ Blood Pressure %	Pattern
	F	32	83	11	13	Output
	F	23	84	19	23	Output
	F	17	91	18	20	Output
	F	31	93	14	15	Output'
	F	48	111	20	18	Output
	F	34	92	3	3	Output
	F	39	73	24	33	Output
	F	32	9?	12	13	Output
	M	32	95	11	12	Resistance
	M	41	98	7	7	Output
	M	48	99	7	7	Output
	M	58	109	20	19	Output
	F	20	93	8	9	Output
	F	28	95	12	13	Output
	F	35	86	11	12	Output
	F	34	78	4	5	Mixed
	F	21	95	15	16	Mixed
	M	40	90	15	17	Mixed
	M	19	86	10	12	Mixed
	M	26	104	1?	12	Mixed
	M	49	86	4	5	Mixed
	M	29	84	12	14	Resistance
	M	41	86	16	19	Resistance
	M	63	85	2	?	Resistance
	F	45	93	7	8	Resistance
	M	24	93	8	9	Resistance
	M	25	91	6	7	Resistance
	F	16	81	2	2	Resistance
	F	27	100	2	2	Resistance
Mean		33 5	91 2	10 76 ± 6 11	11 97 ± 7 08	

Patterns O = 14 R = 9 M = 6

First interviews only used in computing mean values

† Each value in these columns is the average of from 2 to 16 blood pressure determinations

Table I—*continued*

Number or Letter	Sex	Age	Mean Resting Blood Pressure†	Δ Blood Pressure†	Δ Blood Pressure σ	Pattern
59	M	54	99	17	17	Output
61	F	35	146	38	26	Output
62	F	43	137	5	4	Resistance
63	F	43	138	21	15	'Resistance'
64	M	49	145	25	17	'*Output*'
65	F	62	132	20	15	Output'
67	F	31	1) 97	21	22	Mixed
			2) 100	12	12	'Output'
68	M	42	109	9	8	Mixed
72	F	39	112	23	21	Output
73	F	20	1) 112	26	23	Mixed
			2) 108	29	27	'Resistance'
76	M	40	1) 170	21	12	*Output'*
			2) 130	18	13	Output
			3) 137	32	23	Output
			4) 171	11	6	Output'
			5) 171	20	12	Output
81	F	57	135	16	12	Resistance
85	M	38	126	9	7	Mixed
89	F	52	154	29	18	Resistance
90	F	31	138	18	13	*Resistance'*
94	F	51	152	6	4	Output
98	M	33	1) 129	16	12	'Output
			2) 124	34	27	Resistance'
99	M	39	154	18	12	Mixed
101	M	31	116	5	4	Output
103	M	36	172	26	15	'Output
106	M	26	1) 150	19	13	Mixed
			2) 148	24	16	*Output'*
111	F	62	132	15	11	Output
N	M	55	110	23	21	Output
O	F	61	121	12	10	Output
P	F	46	156	11	7	Output
Q	F	51	159	18	11	Mixed
R	F	44	142	33	23	Mixed
S	M	25	134	16	12	Output
T	F	41	142	11	8	Output'
U	F	42	140	30	21	'Output
V	F	46	149	10	7	Output
W	F	49	125	15	12	*Output'*
X	M	47	165	6	4	Output
Y	M	41	139	8	6	Resistance

TABLE II

Correlation of hemodynamic response of cold pressor test with those encountered during interview

Patient No	Cold Pressor Response	Interview Pattern
1	Output'	"Resistance
	'Output"	Resistance'
6	Output	Output"
	Output	Output'
	'Resistance'	Mixed
	Mixed	"Output'
8	Resistance'	Mixed
12	Output	Mixed
13	Resistance	Resistance"
	Resistance'	Resistance'
18	Output'	Output'
24	Resistance	Resistance
28	Resistance'	"Resistance'
29	Mixed	Resistance
55	Output	Mixed
56	Mixed	Resistance"
81	Output	Resistance"
85	Output	Mixed
90	Output	'Resistance
106	Output'	Mixed
	Output	Mixed
	Mixed*	Resistance"
I†	Output	Output'
II	Output	"Output
III	Output'	Output
IV	Output ‡	Mixed

* Postsympathectomy

† Roman numerals refer to hypertensive patients not included in the survey (Chapter VIII)

‡ B P dropped during cold pressor test

served following short term traumatic interviews did not necessarily correspond to that evoked by the cold pressor test in the same individual Neither did the cold pressor test always evoke the same response even in the same individual It was also clearly shown that the pattern of hemodynamic reaction to cold water, or symbolic stresses did not correlate with the presence or absence of evident arteriolar disease

Correlation of Cold Pressor Effects with Interview

In Table II are shown the variety of hemodynamic effects observed in 26 studies performed on 19 hypertensive patients during both cold pressor test and interview carried out on the same day A pressor reaction occurred in every instance with interview and with cold water in every instance but one It will be noted that in 16 of the 26 instances the cold water induced a "high output" type of response while a "high resistance" pattern occurred in 6 and a mixed pattern in 4 The interview, on the other hand, produced a "high output" type of pressor response in only 7 of the 26 tries a "high resistance" pattern in 11 and a mixed pattern in 8 Some of the patients reacted differently on different occasions It was clear that the cold pressor test did not provide a prototype of the individual's hemodynamic pattern of reactions under stress

Renal Blood Flow

Regardless of the underlying hemodynamic pattern, elevations of blood pressure were uniformly associated with a fall in renal blood flow, as measured by the para aminohippuric acid technique of Homer Smith and his associates

In studies done in collaboration with John Pfieffer and Herbert S Ripley, we found that among 35 hypertensive and 13 normotensive subjects it was invariably possible, by introducing topics which aroused serious conflict to bring about a sharp rise in both systolic and diastolic pressures (63) These were more or less sustained throughout the period of the traumatic interview and often outlasted it In no instance were the technical manipulations involved in the test or idle conversation effective in raising the blood pressure The character of disturbance in the subjects was

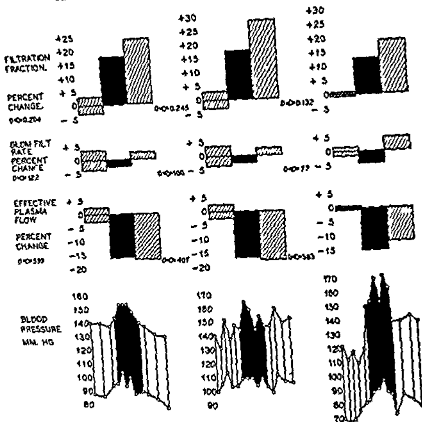


FIG 20 Changes in the blood pressure and renal hemodynamics in representative subjects The first section of cross hatching represents the range of variation of three separate control periods The mean value in each instance is shown at the left of the scale as 0⇒ The solid black column represents the average change during the periods of traumatic interview and the last cross hatched column shows the average change in the postinterview periods

the renal plasma flow and glomerular filtration rate operated more consistently to produce a rise in the filtration fraction In addition it can be seen that the variations did not necessarily parallel the blood pressure response the renal hemodynamics being disturbed long after the latter returned to normal

Utilizing the ratio of mean blood pressure to effective blood

not one of sudden fright or alarm, as in the case of the patients reported by Smith (1), who had earlier observed a fall in renal blood flow in association with stress Our subjects, on the contrary, usually appeared more restrained, without sweating or tremor, and displayed none of the usual evidences of "nervousness" Despite their relative outward calm, however, they commonly asserted that they had felt anxious, frustrated or resentful during the interview and often evidences of tension and restlessness were observable *The details of these studies are included in* a separate publication, but the prototype of the response is shown in Figure 20

Both hypertensive and control subjects whose blood pressures rose during the interview situation displayed evidence of renal vasoconstriction *with a sharp reduction in the effective* renal plasma flow and increased filtration fraction

Effective Plasma Flow, Glomerular Filtration Rate and Renal Vascular Resistance

The average effective plasma flow, when corrected for body surface area, was 509 plus or minus 94 2 cc per minute (This is low when compared to the figures given by Goldring and Chasis (64) 697 plus or minus 151 cc per minute for males and 594 plus or minus 102 cc per minute for females)

During the discussion periods there was an average decrease of minus 26 5 plus or minus 30 1 cc per minute in the effective plasma flow in the normotensive group

The hypertensive group had still a lower renal plasma flow, 460 plus or minus 110 cc per minute, and exhibited a decrease of minus 42 4 plus or minus 52 6 cc per minute during the stress period

In general, during the period of stress and in some cases for a considerable time thereafter, there was a change in the renal hemodynamics *characterized by a fall in the effective plasma flow*, insignificant changes in the glomerular filtration rate and a rise in filtration fraction When the individual cases were examined and the standard deviations consulted, it is seen that there was more uniformity in this change than in the others—the variations in

TABLE III

Comparison of control values and changes in clearances blood pressures and vascular resistances in the normotensive and hypertensive groups

A erage Values	Normot ns e	Hype t ns ve	P
Average Control Periods			
Mean blood pressure (mm Hg)	93 5 ± 9 9	137 3 ± 19 4	<0 01
Effective plasma flow (cc /min)	509 0 ±94 2	460 4 ±110 3	<0 3
Glomerular filtration rate (cc / min)	89 1 ±11 9	10? 5 ± 23 4	<0 05
Filtration fraction	0 1,6± 0 0?1	0 ?25± 0 035	<0 001
Peripheral resistance (mm Hg/ cc /min)	0 098± 0 034	0 171± 0 054	<0 001
Average Discussion Periods			
Mean blood pressure (mm Hg)	10? 6 ±1? 8	151 4 ± ?0 7	<0 001
Effective pla ma flow (cc /min)	48? 3 ±77 3	418 0 ± 99 1	<0 05
Glomerular filtration rate (cc / min)	88 8 ±13 2	102 6 ± 26 8	<0 1
Filtration fraction	0 186± 0 023	0 247± 0 030	<0 001
Peripheral resistance (mm Hg/cc / min)	0 1??± 0 0??	0 21?± 0 066	<0 001
Average Postdiscussion Periods			
Mean blood pressure (mm Hg)	97 8 ±10 4	137 5 ± 16 9	<0 001
Effective plasma flow (cc /min)	493 2 ±84 8	414 2 ± 81 6	<0 01
Glomerular filtration rate (cc /min)	88 3 ±18 1	99 9 ± ?6 ?	<0 2
Filtration fraction	0 180± 0 0??	0 241± 0 038	<0 001
Peripheral resistance (mm Hg/ cc /min)	0 112± 0 0?1	0 186+ 0 048	<0 001
A rage Ch ges	N rm t	Hypert	P
Discussion—Control Periods			
Mean blood pressure (mm Hg)	+9 3±5 7 (<0 01)	+17 3±10 8 (<0 001)	<0 02
Effective pla ma flow (cc /min)	−?6 5±30 1 (<0 01)	−42 4±52 6 (<0 001)	—
Glomerular filtration rat (cc / min)	−0 8±5 7 (—)	+0 0±6 9 (—)	—
Filtration fraction	+0 011±0 009 (0 001)	+0 0??±0 018 (0 001)	<0 05
Peripheral resistance (mm Hg/ cc /min)	+0 014±0 01? (<0 001)	+0 041±0 0?6 (<0 001)	<0 01
Postdiscussion—Control Periods			
Mean blood pressure (mm Hg)	+2 7±6 4 (<0 2)	+3 0±" 1 (<0 1)	—

flow (corrected for body surface area) as a crude indication of the vascular resistance of the kidney, other inferences were made possible. In both groups there were large increases in the renal vascular resistance, 0.014 plus or minus 0.012 units in the normotensive and 0.041 plus or minus 0.026 units in the hypertensive group (see Figure 21 and Table III). As might be expected, the control values in the latter group were considerably higher at the start. It is noteworthy that among the hypertensive group the renal vascular resistance did not return to control levels promptly after

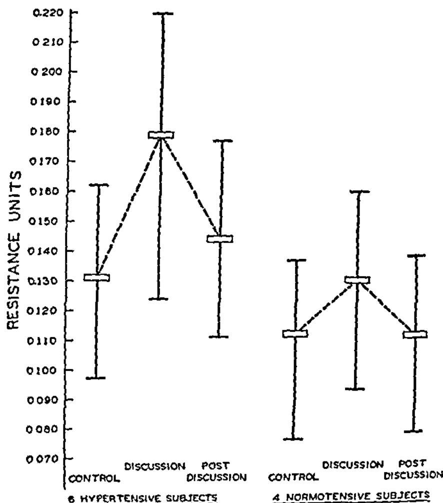


FIG 21 A comparison between the renal vascular resistances in hypertensive and normotensive subjects during stressful interviews

Variations in the Blood Pressure, Effective Plasma Flow Glomerular Filtration Rate and Renal Vascular Resistance During Relaxation

The converse of the above experiments was exhibited when in attempting to restrict the sphere of attention by the use of Sodium Amytal one hypertensive subject became very relaxed and indulged in pleasurable fantasies before the interview was started An effort was then made to promote and maintain this relaxation The blood pressure fell from an average control level of 197/109 to 152/92

During the fall in the blood pressure there was a rise in the effective plasma flow of 24 per cent and in the glomerular filtration rate of 30 per cent with little change in filtration fraction (Figure 22) At the end of the clearance period when the subject was aroused from his pleasurable relaxation the blood pressure returned sharply to control levels, as did the other values

Comment

The observation that the arterial pressure and renal clearance may change toward normal during relaxation supports the view that the rise in pressure and the fall in clearances during the interview situations are truly a reaction to stress and suggests, in addition that the subject with essential hypertension may well be living in a sustained state of overreaction to the minor stresses of daily life The mechanism producing increased blood pressure and responses of this type in essential hypertension has been the subject of intensive investigation Evidence has been adduced both to implicate the kidney as the genesis of elevated blood pressure and on the other hand to indicate the kidney as a passive sufferer from systemic vascular disease Our studies shed no light upon this problem except insofar as they indicate a more intense renal vascular responsiveness in the hypertensive which may, in itself be damaging to the kidney

Simultaneous Measurement of the Renal and General Hemodynamics

In order to correlate the above data with the studies of general hemodynamics and to ascertain whether or not the decrease ob

TABLE III—(*Continued*)

Average Changes	Normotensive	Hypertensive	P
Effective plasma flow (cc /min)	−22 7±30 4 (<0 02)	−34 5±49 6 (<0 01)	—
Glomerular filtration rate (cc / min)	−0 6±2 3 (—)	−0 2±6 6 (—)	—
Filtration fraction	+0 005±0 013 (<0 2)	+0 015±0 021 (<0 01)	<0 2
Peripheral resistance (mm Hg/ cc /min)	+0 005±0 010 (<0 1)	+0 017±0 026 (<0 01)	<0 2

a) The normotensive group consisted of 13 subjects The hypertensive group consisted of 20 to 22 subjects This variation was taken into consideration in the *calculation of t Each figure is followed by its standard deviation*

b) *P* represents the degree of probability that the two figures on the same horizontal row are not significant and was obtained from the tables of distribution after calculation of *t* The omissions signified by dashes indicate that *P* was greater than 0 2 *Levels of 0 01 or less are to be considered significant*

$$t = (\bar{X}_1 - \bar{X}_2) \sqrt{\frac{n_1 - n_2 (n_1 + n_2 - 2)}{(n_1 + n_2)(\Sigma x_1 + \Sigma x_2)}}$$

$$\Sigma x = \Sigma X^2 - \frac{(\Sigma X)^2}{n}$$

c) The figures in parenstheses beneath each value represent *P* with the same significance as under (b) regarding the respective average differences immediately above *t* was calculated as follows

$$t = \frac{\bar{X}}{S\,D/\sqrt{n}} \qquad S\,D = \sqrt{\frac{X^2 - \frac{(\Sigma X)^2}{n}}{n - 1}}$$

the subsidence of the pressor response Thus in both normotensives and hypertensives the kidney adjusted itself by means of vasoconstriction to the rise in the systemic blood pressure, preventing an increase of the blood flow through it There is suggestive evidence that the hypertensive kidney overcompensates so that it exhibits both a more intensive and more prolonged constriction, *even after the blood pressure has returned to near control levels*

The observations of Hoobler are of interest in this respect He showed that about the same proportion of hypertensive and normotensive subjects underwent marked renal vasoconstriction in response to the inhalation of carbon dioxide (158)

noted 16 years earlier during her first pregnancy Episodes of dizziness were closely correlated with stressful incidents in her life chiefly concerning her alcoholic husband At her first visit to the clinic her blood pressure was 236/148 The physical examination showed her heart to be moderately enlarged and there was a faint basal systolic murmur The radiological examination of her chest also showed enlargement of the left heart electrocardiogram showed left axis deviation The results of observations on this patient during an interview are shown in Figure 23 After a preliminary period of rest and relaxation in which there was no conversation the patient was engaged in the discussion of marital life by one of the physicians She described the alcoholism of her husband and its effects upon her son and herself During the discussion she appeared anxious and resentful Her blood pressure rose from 186/128 to 242/168

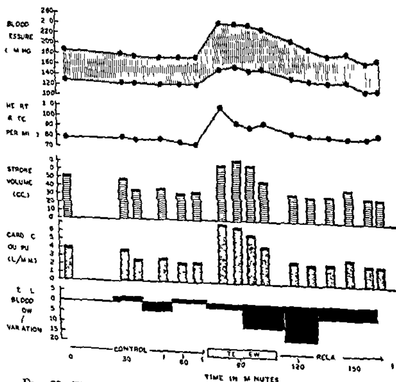


FIG 23 The correlation between measurements of the renal blood flow and general hemodynamics during a stressful interview prior to lumbodorsal sympathectomy

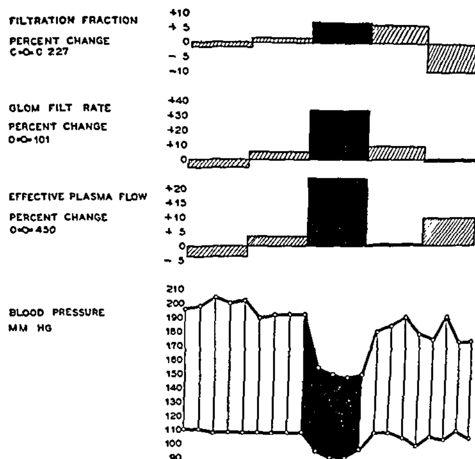


FIG 22 Changes in the renal hemodynamics associated with a fall in the blood pressure in a hypertensive person during relaxation induced by intravenously injected Sodium Amytal

served in renal blood flow actually represented vasoconstriction, rather than reflecting a fall in cardiac output measurements of the renal hemodynamics were made in 2 subjects while they lay on the ballistocardiograph table before during and after stressful interviews

CASE 10 *Decrease in renal blood flow associated with pressor response of alternating type induced by stressful interview with a hypertensive woman who ultimately underwent sympathectomy*

A 45 year old Swedish housewife was referred to the clinic because of dizziness and headaches related to hypertension which had been first

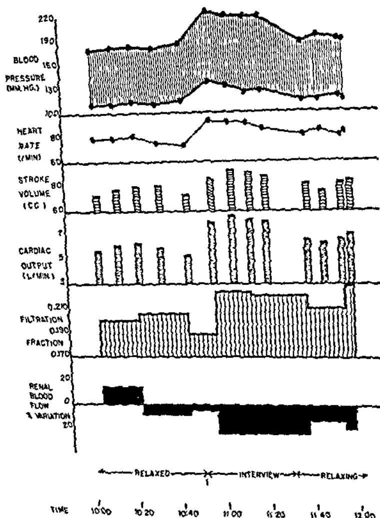


FIG 24 A second patient in whom simultaneous estimations of renal blood flow and general hemodynamics were made prior to lumbodorsal sympathectomy

pyrogens can be neutralized by the vasoconstrictor response during an incident of *mounting* resentment

During measurements of renal blood flow by Bradley in a patient with essential hypertension a considerable increase in renal flow associated with a fall in arterial pressure had been achieved

and there were concomitant elevations in the heart rate, "stroke volume" and "cardiac output" During this period the "peripheral resistance," which is not shown in the figure, fell from 89 to 13 There was a decrease in renal flow and an increase in the filtration fraction At the end of the interview the patient became quiet and apparently calm The stroke volume and pulse fell but there was a persistent elevation of the blood pressure associated with a sharp rise in peripheral resistance of 98 units During this period the renal flow remained decreased Finally, the blood pressure, peripheral resistance and renal blood flow all returned to essentially their original values

CASE 11 *Decrease in renal blood flow associated with pressor response of "high output" type induced by stressful interview with a hypertensive woman who ultimately underwent sympathectomy*

A 42 year old woman came to the clinic because of repeated episodes of dizziness She was found to have hypertension with readings around 180/110 Physical and laboratory studies failed to reveal any evidence of heart disease or other structural abnormality Observations of the systemic and renal circulatory dynamics in this patient during an interview are shown in Figure 24 After an initial period of relaxation during which control observations were made, the physician talked to the patient about some of her conflicts, such as her preoccupation with the behavior of her adolescent daughters In this instance the physician adopted a tone of noncommital interest which was interpreted by the patient as unfavorably judicial She became tense and irritated During the period of the interview her blood pressure rose from 180/110 to 220/136 At the same time the heart rate and 'stroke volume' increased and "peripheral resistance' (not shown in the figure) fell from 36 to 30 units There was a fall in the renal blood flow and an increase in the filtration fraction indicative of renal vasoconstriction At the close of the discussion the physician offered friendly reassurance to the patient and she was encouraged to relax while further observations were made The blood pressure and 'cardiac output" fell somewhat and the peripheral resistance" again rose, although these values did not return to their original levels before the close of the experimental period The renal blood flow further increased slightly and the filtration fraction fell slightly indicating a persistence of renal vasoconstriction

Modification of Effects by Pharmacodynamic Agents

The observation of Wilkins (66) is of special interest in this connection since he showed that the potent vasodilator effects of

who was admitted to the New York Hospital on May 14, 1952 with the chief complaint of weakness for 16 years and headaches for seven months

The patient had felt well until 10 years before admission, when he began to lose energy He lacked interest in his work and his extremities felt weak and heavy He was tired on arising in the morning and for the past five years had noted decrease in libido, with ultimate impotence about one year before admission

Numerous physical examinations done in the past because of these complaints had shown his blood pressure to be normal including one examination done one year before admission For about seven months he had had severe generalized headaches which were progressively worse up to the time of admission For three months he had noticed some blurring of vision and flashes of light In the examination his blood pressure was 216/130 There were hemorrhages exudates and papilledema in the optic fundi The heart did not appear enlarged to percussion or on x ray and there were no signs of congestive failure A horseshoe shaped mass was palpable in the abdomen Blood counts were normal but there was 1 plus albuminuria Blood urea nitrogen was 13 Electrocardiogram showed left axis deviation with inversion of T waves in some precordial leads Retrograde pyelogram showed a horseshoe kidney with some caliectasis but no evidence of superimposed pyelonephritis

Abdominal aortograms showed normal abdominal aorta and renal arterial tree Differential urea clearance studies showed satisfactory excretion by both kidneys A regitine test for pheochromocytoma was negative

The patient was placed on a rice diet and received hexamethonium subcutaneously every eight hours Blood pressure fell considerably

He had been born in a small town in Norway the second child and only son He described his birth early development and adolescence as just like anybody else His mother was described as kindly but not overtly affectionate or warm When the patient was a small child his father developed a slowly progressive neurological disorder which consisted principally of weakness in all four extremities He eventually became a total invalid and finally died when the patient was 35 years old

After completing high school the patient went to sea when he was 19 and continued to work in the Merchant Marine until age 30 At that time he married and settled in New York City working in a firm which built and repaired Diesel engines He had two children within the first two years of the marriage He described his home life and his occupation

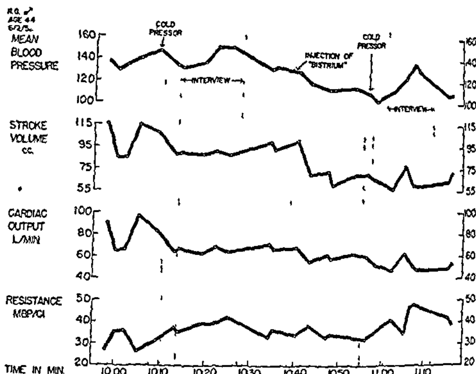


FIG 25 Comparison of the pressor effects of immersing the hand in cold water and a stressful interview before and after injection of hexamethonium bromide (Bistrium) 20 mg subcutaneously Note that the pressor response to interview was as vigorous after hexamethonium as before although the base line of mean blood pressure was lower

until a subject of significant personal conflict was brought up for discussion Almost immediately the blood pressure rose again and the increase in renal blood flow achieved by the pyrogen was obliterated

The experience of Freis has already been quoted In his patient although a satisfactory reduction of blood pressure had been achieved with the use of antipressor drugs the effects were obliterated by the circumstances of a visit to the doctor's office Similar instances are reported by Shapiro and Grollman (67)

CASE 12 *Failure of hexamethonium to block pressor response to interview despite dosage adequate to block cold pressor effect*

The limitations of hexamethonium, even when administered parenterally, are illustrated by the case of a 44 year old machine shop worker

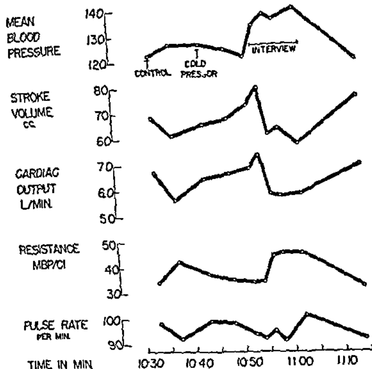


Fig 26 Observation of hemodynamic response to cold pressor test and to interview in Case 8 following bilateral lumbodorsal sympathectomy

of high resistance can occur readily despite removal of the sympathectic chains and ganglia In fact it would appear that after sympathectomy there was a greater tendency for blood pressure rises during stress to be attributable to increased "resistance than to a rise in cardiac output If the high output" pattern is due to the release of epinephrine from the adrenal medulla under sympathectic stimulation, it may be that denervation of the adrenal glands by thoracolumbar sympathectomy reduces the likelihood of this type of response It is noteworthy however that either pattern might occur

as perfectly satisfactory He denied any conflicts or worries, except "the *sort of thing that everybody has* " *It was difficult to study this patient* because of his extremely reserved and guarded manner, his laconic, withdrawn behavior, and his inability to express feeling states of any sort Because of his impotence and because the symptoms of weakness had had their onset soon after his marriage, however, it was decided to discuss his wife during the recording of the ballistocardiogram

As noted, he had been receiving hexamethonium every eight hours His morning dose was omitted on the day of the study (Figure 25) The cold pressor test and discussion of his wife both evoked brisk pressor responses He was then given 20 milligrams of hexamethonium bromide subcutaneously Within 15 minutes of the injection reclining mean arterial pressure had fallen from 135 to 115 A cold pressor test produced no rise in blood pressure, but discussion of his wife caused as brisk a rise in blood pressure as it had before the hexamethonium Mean arterial pressure reached 145 This finding is in keeping with the earlier demonstration by Reiser and Ferris that sympathetic blockade abolished the cold pressor effect without necessarily eliminating the response to stress (144)

Modification of Hemodynamic Effects by Sympathectomy

CASE 8 *Failure of cold pressor response following thoracolumbar sympathectomy but persistence of the pressor response to a stressful interview*

A 30 year old woman described on page 79 was ultimately subjected to bilateral thoracolumbar sympathectomy A month after completion of the last stage she was studied again while on *the ballistocardiographic* table It will be noted from Figure 26 that, although there was no pressor response to immersion of the hand in cold water, a discussion of the same topic which had induced a pressor reaction before operation did so again afterwards

Five additional subjects were studied on the ballistocardiographic table before and after thoracolumbar sympathectomy and 7 additional subjects after sympathectomy only The postoperative studies were done from two weeks to five years after the operation was completed From the data in Table IV it is clear that peripheral vasoconstriction sufficient to produce a pattern

constantly angry, but she seldom fought back Her major satisfaction was her relationship with her first child For years she comforted herself with the thought that she could always leave her husband, until, after three pregnancies late in marriage, she felt irrevocably committed to him When sympathectomy was urged by a physician in another clinic of the New York Hospital she accepted without protest although she believed her hospitalization would force the family into debt Nevertheless an operation was decided upon In two interviews before the operation, during discussion of the operation and its cost and of her boorish husband there occurred elevations of blood pressure of 18 and 16 mm. attributable solely to increased 'peripheral resistance In a later postoperative interview comparable elevations of blood pressure occurred with increased stroke volume at one time and increased resistance at another

Modification of Renal Hemodynamic Effects by Sympathectomy

Patients 10 and 11 described earlier and studied while both general and renal hemodynamics were being measured were again observed according to the same technique following bilateral thoracolumbar sympathectomy The first patient's interview was accompanied by a rise in the blood pressure as shown in Figure 27 There was noted a preliminary increase in 'cardiac output' without change in the blood pressure Later, when the blood pressure rose peripheral resistance' increased significantly Following the interview the patient was reassured and she became more relaxed At this point the measured indicators fell again toward control levels until at the end of the experimental period she became restless once more and her 'cardiac output' rose again There was no significant change in the renal hemodynamics during this interview a finding observed in several sympathectomized patients and reported separately elsewhere (56 57)

The reactions of patient 11 after sympathectomy were so similar as to be almost identical with those of patient 10 In other persons, however the pressor response to stress after thoracolumbar sympathectomy was dependent chiefly upon an increased "peripheral resistance Nevertheless renal blood flow was not greatly altered

Six subjects who underwent lumbodorsal sympathectomy for essential hypertension displayed a considerable rise in the blood

TABLE IV

Hemodynamic response to interview before and after sympathectomy

Patient No	Time	Pattern	Resting B P	ΔP	ΔP	ΔCO	ΔCO	ΔR	ΔR
				mm Hg	%	*L/min*	%	units	%
8	Pre op	Mixed	123	+20	+16	+0 5	+8	+3	+8
	2 wks p o	Resistance"	122	+14	+11	−0 6	−9	+8	+24
12	*Pre op*	*Mixed*	*133*	*+12*	*+9*	*+0 1*	*+2*	*+3*	+8
	13 mos p o	Resistance'	117	+18	+15	−0 7	−11	+12	+35
13	Pre op	'Resistance'	127	+18	+14	−0 1	−2	+9	+1[illegible]
	2 wks p o	Resistance	129	+16	+13	−1 2	−38	+51	+[illegible]6
18	33 mos p o	Mixed	120	+30	25	+0 5	+11	+4	+9
106	Pre op	Mixed	148	+24	+16	+0 8	+19	+2	+3
	13 mos p o	Resistance'	125	+10	+8	0	0	+5	+12
I*	Pre op	Output	125	+15	+12	+1 5	+35	−10	−19
	2 wks p o	Resistance	119	+4	+3	−0 4	−10	+6	+12
II	Pre op	Mixed	159	+18	+11	+0 6	+5	+2	+8
	2 mos p o	Resistance	150	+12	+8	−1 0	−10	+4	+14
III	Pre op	Output'	165	+6	+4	+1 4	+18	−5	−13
	2 wks p o	Resistance'	154	+4	+3	−0 4	−7	+6	+13
IV	12 mos p o	Output	116	+7	+6	+0 3	+9	−3	−5
V†	28 mos p o	Mixed	114	+8	+7	+0 1	+3	+3	+5
VI†	60 mos p o	Output	158	+10	+12	+1 2	+34	−9	−13
VII	1 mo p o	Output'	150	+12	+8	+0 5	+9	0	0
VIII	2 wks p o	Output	100	+11	+11	+0 7	+17	−2	−4
IX‡	36 mos p o	'Resistance	180	+9	+5	−1 0	−14	+8	+24

* Roman numerals refer to hypertensive patients not included in the survey (Chapter VIII)
† Total sympathectomy
‡ Chronic glomerulonephritis

CASE 13 *Failure of thoracolumbar sympathectomy to block pressor responses to stressful interview of "high resistance" type*

A 37 year old housewife had developed hypertension in the course of her last two pregnancies, three and two years before the study Seventeen years previously she had become pregnant by a man who was killed in an automobile accident shortly before their projected marriage She stayed at home with her parents and kept the girl, a child A compliant person, she was persuaded by her parents to marry a boarder He was an older man whom she despised—coarse, brutal and stupid, but she was finally convinced that with an illegitimate child she couldn't hope to do better He was a city employed road surfacer She became a practical nurse and usually earned more than her husband His abuses kept her

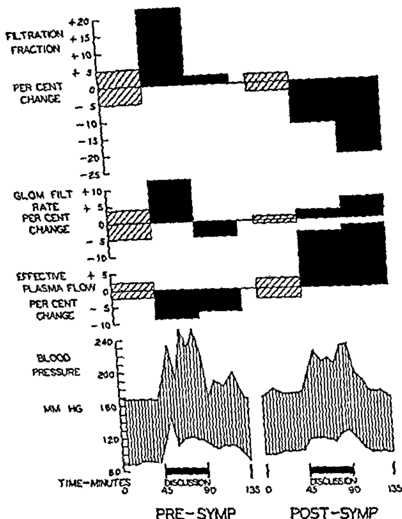


FIG 28 Changes in the blood pressure and renal hemodynamics before and after bilateral thoracolumbar sympathectomy

formulae of Lamport an increase in both the afferent and efferent arteriolar resistance (68) In 2 of these subjects one of which is shown graphically in Figure 28 there was a complete reversal of the pattern with a decrease in calculated renal vascular resistance following operation In the others there was either a failure of the filtration fraction to rise or of the effective plasma flow to fall as

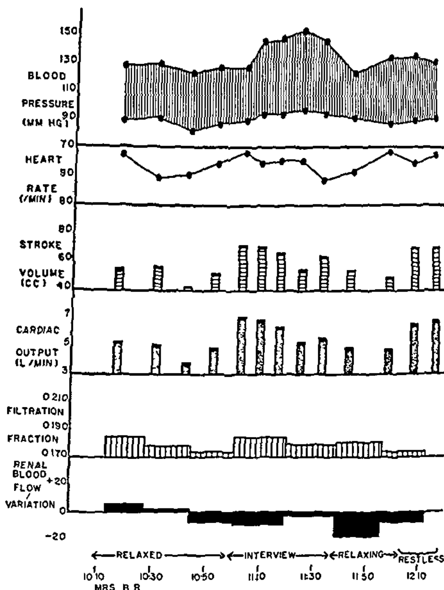


FIG 27 Observations of general and renal hemodynamics made on the same subject as illustrated on Figure 23 following bilateral lumbodorsal sympathectomy Note the consistently lowered filtration fraction and the failure of the renal blood flow to decrease significantly except during a period of lowered "cardiac output"

pressure postoperatively during a discussion of disturbing topics, but 5 of the 6 failed to show an increase in the renal vascular resistance, although prior to operation all of these and the rest of the 35 unsympathectomized subjects displayed, according to the

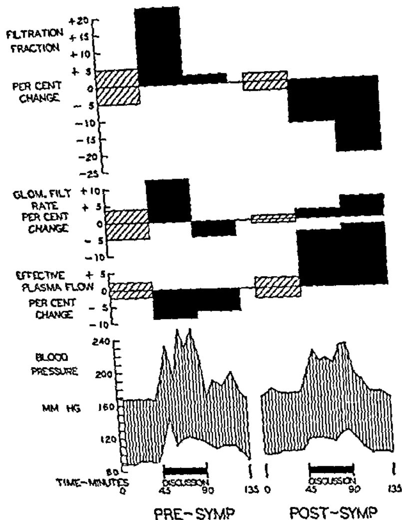


FIG 28 Changes in the blood pressure and renal hemodynamics before and after bilateral thoracolumbar sympathectomy

formulae of Lamport an increase in both the afferent and efferent arteriolar resistance (68) In 2 of these subjects one of which is shown graphically in Figure 28 there was a complete reversal of the pattern with a decrease in calculated renal vascular resistance following operation In the others there was either a failure of the filtration fraction to rise or of the effective plasma flow to fall as

TABLE V

Changes in renal response to stressful interview before and after bilateral thoracolumbar sympathectomy

Op	Patient No	Sex	Proc	B P	EPF	GFR	FF	Δ% EPF	Δ% GFR	Δ% FF	EBF	PRU	Δ% PRU
Pre	3	F	C	155/85	587	113	0 193	±0 9	±1 2	±0 1	1089	0 104	±1 4
			D	188/104	478	114	0 239	−18 6	+0 9	+22 8	885	0 156	+50 0
			PD	145/93	451	115	0 255	−23 2	+1 8	+25 4	835	0 137	+31 7
Post			C	162/92	486	118	0 242	±2 9	±0 0	±2 9	868	0 138	±5 5
			D	182/110	478	115	0 240	−2 0	−11 0	−0 8	854	0 163	+18 1
			PD	159/96	501	105	0 196	+3 5	−18 5	−19 2	895	0 137	−0 7
			PD	148/88	503	97	0 198	+3 1	−17 8	−18 2	899	0 170	−15 0
Pre	X	F	C	164/91	527	88	0 167	±1 7	±5 6	±4 3	870	0 190	±2 1
			D	220/120	483	99	0 205	−8 3	+12 5	+22 7	805	0 230	+21 1
			PD	194/106	491	84	0 171	−6 8	−4 4	+2 4	819	0 184	+3 2
Post			C	176/103	279	75	0 269	±1 1	±0 7	±1 8	481	0 274	±0 3
			D	211/116	324	77	0 237	+16 8	+2 3	−11 1	559	0 276	+0 7
			PD	174/103	330	71	0 214	+18 3	−6 8	−20 4	569	0 230	−16 0
Pre	XI	F	C	165/102	381	76	0 198	±2 9	±2 8	±2 0	669	0 190	±2 1
			D	185/113	351	72	0 205	−7 9	−4 5	+3 8	621	0 230	+21 1
			PD	168/102	397	75	0 189	+4 2	−0 4	−4 6	696	0 184	−3 2
			PD	161/101	417	76	0 183	+9 5	±0 0	−0 1	732	0 171	−10 0
Post			C	175/110	372	68	0 184	±1 1	±2 3	±3 3	591	0 230	±1 3
			D	189/121	383	76	0 196	+3 0	+10 5	+7 3	608	0 243	+5 7
			PD	174/116	395	71	0 180	+6 1	+3 7	−2 2	627	0 222	−3 5
			PD	175/109	419	70	0 167	+12 6	+2 3	−9 2	665	0 203	−10 0
Pre	XII	F	C	179/110	511	101	0 198	±5 7	±5 1	±4 1	852	0 162	±7 6
			D	190/118	399	89	0 223	−21 9	−12 5	+12 4	665	0 239	+47 5
			PD	184/115	430	95	0 221	−16 0	−6 8	+11 4	715	0 200	+23 4
Post			C	129/88	588	105	0 179	±4 5	±5 3	±3 4	980	0 106	±5 6
			D	147/95	535	97	0 182	−9 1	−7 7	+1 7	891	0 130	+27 6
			PD	134/90	509	90	0 178	−13 4	−14 3	−0 9	848	0 127	+19 8
Pre	XIII	F	C	173/123	317	67	0 212	±4 1	±5 4	±2 4	567	0 248	±1 2
			D	236/153	292	74	0 254	−7 9	+10 7	+19 8	530	0 351	+41 9
			PD	189/126	288	67	0 234	−9 2	±0 0	+10 4	523	0 308	+23 2
			PD	173/120	285	57	0 199	−10 1	−13 9	−6 1	518	0 272	+9 7
Post			C	201/126	297	59	0 199	±3 4	±4 8	±4 0	495	0 315	±5 6
			D	227/143	326	68	0 210	+10 3	+15 2	+5 3	546	0 324	+2 9
			PD	193/128	312	63	0 203	+4 9	+6 8	+2 0	519	0 297	−5 7
Pre	XIV	M	C	219/113	320	82	0 256	±6 8	±5 2	±4 6	659	0 235	±6 3
			D	235/126	314	85	0 272	−1 8	+4 4	+6 3	647	0 263	+11 9
			PD	217/112	352	84	0 240	+9 8	+3 3	−6 3	725	0 210	−8 5
Post			C	208/108	424	90	0 213	±7 7	±5 7	±5 7	771	0 192	±5 7
			D	221/120	399	83	0 207	−6 0	−8 7	−2 8	725	0 221	+15 1
			PD	218/113	443	94	0 212	+4 5	+3 9	+0 5	805	0 190	−1 0

Proc = procedure C = control periods D = discussion periods PD = post discussion periods B P = blood pressure in mm Hg EPF = effective plasma flow CFR = glomerular filtration rate FF = filtration fraction EBF = effective blood flow PRU = peripheral resistance units

Roman numerals refer to patients not included in the survey (Chapter VIII)

shown in Table V It is of interest that in the one subject whose efferent arteriolar constrictor response was not abolished, the lower portion of the sympathetic chain, L_1, was not identified in the specimen examined postoperatively and, presumably, had not been removed as intended

For comparison, because Gomez (69) has developed a different mathematical treatment of renal hemodynamics, the efferent arteriolar resistance was also calculated by this method The results are also shown in Table II, and are comparable to those obtained with Lamport's fomulae both in magnitude and in direction of change Thus it would appear that during situations of threatening significance, both the afferent and efferent arterioles constrict but that the action of the latter is diminished or abolished after removal of the renal nerve supply by sympathectomy Nevertheless the afferent arteriole is still able to afford the kidney protection itself against a systemic rise in blood pressure

Significance

It is striking from these observations that sympathectomy failed to block or to mitigate the pressor response to stressful interviews This fact invalidates an assumption still frequently seen in the literature that psychogenic effects on arterial pressure are necessarily mediated through sympathectic nerves It is evident that other mechanisms must be involved

CHANGES IN THE PHYSICAL CHARACTERISTICS OF THE BLOOD

In the most widely accepted formula for appraising the various factors responsible for maintenance of blood pressure the factor of blood viscosity equals in weight that of cardiac output and is, therefore not inconsiderable Although the cor bovinum of polycythemia vera is known to be largely due to the increased viscosity of the blood there has not been much interest in the possibility that major fluctuations in viscosity might be important Up to the present investigators have assumed that the blood viscosity remains constant over a short period of observation In view of the importance of the viscosity factor however in determining the efficiency of the heart pump mechanism it seemed worthwhile to explore the possibility of changes in the viscosity and other

physical characteristics of the blood Such studies on sixteen healthy adult volunteers plus nine normotensive and twelve hypertensive patients, were carried out by Schneider who found that a pressor response, however induced, was accompanied in both normotensive and hypertensive subjects by an increase in blood viscosity and a shortening of clotting time (70)

Schneider mentioned the viscosity of the blood by the use of the apparatus described by T'ang and Wang (3) Blood clotting time was determined by using the siliconized tube method as described by Margulies and Barker (71)

Standardization

To attempt to ascertain the reliability of the control method three experiments were carried out on three subjects in which four specimens at approximately 9 30 and 11 00 A M and 2 00 and 4 00 P M were drawn within a single day while each subject went about his usual duties The clotting time in each case remained remarkably constant with a range of deviation of one minute in one subject, five minutes in the second and four minutes in the third subject In approximately one third of the tests the commonly used Lee White method (chemically cleaned dry tubes of the same size and depth, at 37°C) was carried out simultaneously with the silicon method of measurement

The results from the two methods paralled each other, but the spread of values was much greater with the siliconized tube It was concluded that the silicon method was better suited to detecting short clotting times Arbitrarily the mean clotting time of 54 minutes obtained in testing 48 relaxed normotensive control subjects was accepted as the normal clotting time A clotting time of less than 44 minutes was considered accelerated, and a clotting time in excess of 64 minutes was considered prolonged

Relaxed Normotensive Volunteers

Samples of blood were drawn from apparently relaxed healthy volunteers over a six month period to determine the mean value of the clotting time for both males and females by use of the siliconized tube method Thirty seven specimens from 25 women

(nonmenstruating) showed a range from 14 to 69 minutes with a mean value of 54 minutes Six specimens were obtained from 5 women during the first day of menstruation and showed a range from 30 to 38 minutes with a mean value of 34 minutes Twenty one samples were obtained from 18 males The clotting time ranged from 47 to 65 minutes with again a mean value of 54 minutes

Effects of Cold Pressor Test

Nine relaxed normotensive volunteers immersed the left hand in ice water for a five minute period The first blood sample was obtained prior to the immersion of the hand after the blood pressure had stabilized The second specimen was obtained two minutes after the hand was withdrawn from the water and a final specimen of blood was obtained one hour later Subjects were recumbent through out the experiment Four of the 9 subjects failed to get a rise in the blood pressure in excess of 20 mm systolic or 15 mm diastolic after 30 or 60 seconds of the immersion and, according to Hines and Brown would be classified as normal reactors (145)

Five of the 9 subjects had a rise in the blood pressure exceeding 20 mm systolic and 15 mm diastolic after the 30 or 60 second interval of immersion and could, therefore be classified as 'hyper reactors

The normal reactors' failed to show any significant changes in any of the blood measurements The "hyperreactors , however, showed an average shortening of the clotting time by 25 per cent in a specimen obtained following the cold pain experience, with a return to the original values in one hour without changes in the other indicators In all 8 of the 9 subjects experienced varying degrees of pain but the clotting time was shortened only in those subjects who had a pressor response with the pain

In an earlier study it was postulated that the elevation in the arterial pressure which often accompanies the cold pressor test is a part of pain reaction (72) It would appear that the changes in the clotting time observed in these experiments constitute also a reaction to noxious stimulation

Effects of Stressful Interviews

Schneider has reported in detail the changes observed in short term experiments when his subjects were exposed briefly to discussion of personal conflicts (70) When the interviews were predominantly reassuring, unassociated with a rise in the blood pressure, no significant changes in the measured characteristics of the blood were observed (Figure 29) When the interviews aroused conflict, however, with conscious or unconscious anxiety and resentment, there occurred in association with the elevated arterial pressure a shortening of the clotting time (and sedimentation rate and increase in the blood viscosity with a rise in hematocrit) as shown in Figure 30

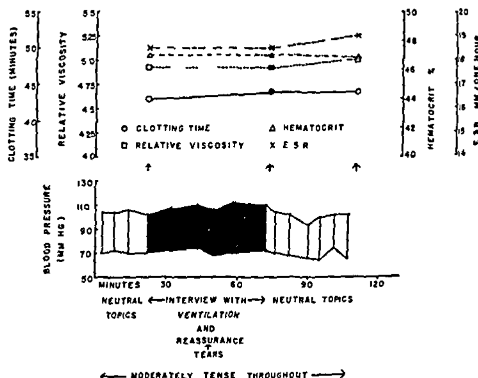


FIG 29 The correlation between the blood pressure response and measurements of the physical characteristics of the blood during a reassuring interview

Day to Day Observations

Day-to-day observations were conducted on both normotensive and hypertensive subjects. The blood pressure was ascertained and the clotting and relative blood viscosity were measured two or three times a week. In the day to day observations carried out in the manner already described, a close correlation was observed between the feeling state, the level of the blood pressure and the measured value of the clotting time and blood viscosity.

Figure 31 illustrates the representative measurements of the clotting time, the blood viscosity and the blood pressure and the feeling state and life situation in two young adult males, one with essential hypertension and one with normal blood pressure.

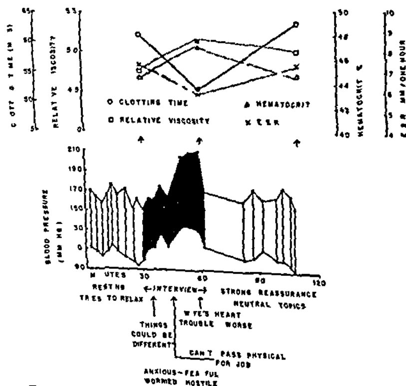


FIG 30 The correlation between the blood pressure and measurements of the physical characteristics of the blood during an interview to which the patient reacted with anxiety and conflict

The Hypertensive Subject

CASE 14 *Increased viscosity and shortened clotting time in a young hypertensive man during periods of elevated blood pressure related to Difficult life experiences*

This patient, a 36 year old office worker, was a serious looking man of average height His manner was tense and shy and his behavior self-effacing He was first discovered to have essential hypertension at the age of 29 while a noncombatant in the Army He was a conscientious, rigid person with marked feelings of inadequacy, who had a great need to do well and to please others He was found to be extremely tense and hostile beneath a pleasant and calm facade and was in strong rivalry with his two siblings His hypertension had developed following the death of his father and the marriage of his younger brother When first seen he was unable to work because of marked anxiety Living at home with his aged

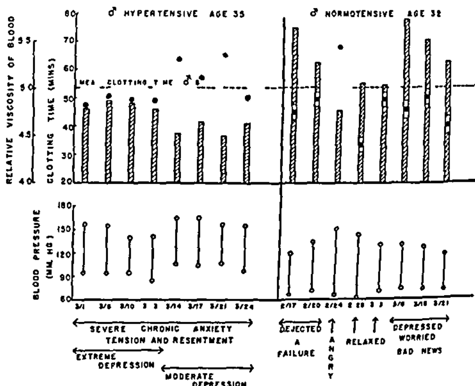


FIG 31 The day to-day correlation between the blood pressure, the clotting time, and the blood viscosity in a hypertensive and normotensive subject

mother supported by his spinster sister, he had made several unsuccessful attempts to marry and emancipate himself from his family

He was studied over a four month period during the first three months of which his blood pressure was nearly always in the hypertensive range He was examined five days a week during this period and the clotting time and relative viscosity of the blood were measured on Tuesdays and Fridays of each week The left half of Figure 31 gives representative measurements of the clotting time relative viscosity and blood pressure levels on the days indicated and note is made of the relation between these values and the patient's emotional status and life situation On March 1, 6 10 and 13 the clotting times (46 to 49 minutes) were just slightly shorter than the average for the relaxed male and the viscosity values (4.80 to 4 90) were within the average range for males The blood pressure ranged from 142/95 to 154/98 On all four of these occasions which were during the first two weeks he was depressed tense preoccupied and anxious Dreams during this period indicated hostility directed at both the brother and father On March 14 17, 21 and 24

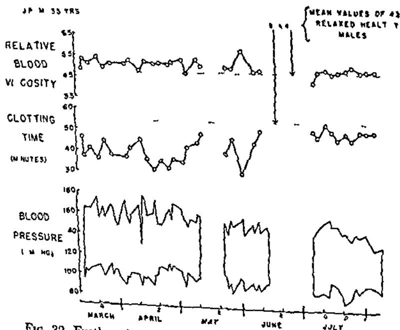


Fig 32 Further observations made on the hypertensive subject in left half of Figure 31

clotting times were distinctly shortened (36 to 44 minutes) and the blood viscosity values were decidedly elevated (4 90 to 5 36) The blood pressure during this period ranged from 155/98 to 164/108 During this two week period the anxiety, resentment and hostility had increased, as evidenced clinically and by such statements on the part of the patient as, "I'm feeling very tense and anxious," "I'm angry with myself at home," and "I feel frustrated and resentful toward my family" His sleep was disturbed by vivid, fearful dreams which suggested sexual anxiety and rivalry with and resentment toward his brother and anxiety and fear in connection with his father Throughout the period of observation the clotting time and relative viscosity of the blood roughly paralleled the changes in arterial pressure

Further measurements and observations made on this patient over the subsequent four months are shown in Figure 32 There was a gradual return to nearly normal blood pressure with the clotting times returning to the average of 50 minutes and the blood viscosity values from 4 6 to 4 8 as he was able to express himself more freely and talk about his resentments and anxieties more directly and frankly Coincident with these changes the patient had shown less evidence of depression The anxiety had decreased enough to permit his return to gainful employment

The Normotensive Subject

CASE M *Normotensive subject showing increased viscosity of blood and shortened clotting time during brief periods of elevated blood pressure related to life stress*

The right half of Figure 31 gives representative measurements over a 10 week period of study of the clotting time and blood viscosity of a healthy, 32 year old physician, together with the blood pressure readings, data on his emotional state and life situation On February 17 and 20, during a period of frustration and lack of progress in his work, the subject felt dejected and depressed Blood pressures were normal and clotting times were prolonged (78 and 64 minutes) The viscosity of the blood was relatively low On February 28 while acting as a volunteer for an experimental procedure, he became anxious and openly angry with the technician who had prepared the equipment incorrectly Note that blood pressure at that time rose to 150 mm systolic clotting time was short (44 minutes) and viscosity of the blood was high (5 4) On February 28 and again on March 3 the subject felt in optimum spirits The blood pressures were normal, the clotting times were nearly exactly those of the mean value in the relaxed male On March 15, 16 and 21 following the

receipt of several letters bearing bad news from home the subject felt overwhelmed and depressed Note the normal blood pressures but the prolongation of the clotting times (as long as 80 minutes) as correlation between feelings of depression and long clotting times were observed

Cannon considered that the acceleration of blood clotting was one of several responses in the organism in time of danger designed to prepare for fight or flight and more specifically, to be regarded as an adaptive process useful to the organism in conserving the blood especially in the struggles of mortal combat (73) It is conceivable that these changes represent a protective reaction pattern in man used during short transient periods of stress, which is beneficial in that the likelihood of excessive blood loss is reduced (short clotting time) and added oxygen demands are satisfied (increased hematocrit and increased blood viscosity) However, it is also conceivable that if such a protective reaction pattern is used for a very long period, perhaps inappropriately then it may no longer be useful but actually become deterimental in that a short clotting time and increased viscosity may predispose to intravascular thrombosis

Moreover it appears that there occurs in the hypertensive subject a significant increase in the over all peripheral resistance especially when his arterial pressure is made to rise further under stress which he feels called upon to meet with a tightly restrained attitude and the avoidance of overt hostility and aggression and the changes in the blood viscosity may form a not inconsiderable part of that change in the peripheral resistance The mechanism whereby these changes are brought about however, remains obscure

Correlation Between Hemodynamics and Measurements of the Physical Characteristics of the Blood

Hypertensive and normotensive subjects were studied simultaneously by the ballistocardiographic and the blood viscosity and clotting time techniques before during and after stressful interviews Whether the hypertensive response was accomplished chiefly by the cardiac output or the peripheral resistance ' blood viscosity increased and the clotting time shortened Thus,

when a rise in the calculated peripheral resistance was observed it was clear that it reflected arterial vasoconstriction

SUMMARY

It is doubtful that any light has been shed on the "cause" of essential hypertension Even the mechanisms involved continue to be elusive It has been shown, however, with appropriate documentation, that hemodynamic changes productive of elevated arterial pressure, reduced renal blood flow and increased blood viscosity occur as a part of an individual's adaptation to problems and challenges in his daily life (76) Special attention has been directed to two contrasting patterns of hemodynamic adjustment which occur alike in hypertensive and normotensive individuals under stress One pattern appears to be identical with the "exercise" pattern described in Chapter II in which occurs an increase in blood pressure attributable to a rise in stroke volume without elevation of peripheral vascular resistance The other pattern resembles that encountered in injury or hemorrhage in which occurs an increase in blood pressure attributable to an elevation in peripheral vascular resistance without a rise in stroke volume When observed during interviews which deal with pertinent personal conflicts, the former or "exercise" pattern was manifest when emotional disturbance was relatively overt, while the "high resistance" pattern was more often encountered with a calm exterior and evidence of suppression or repression of emotion

Two other groups of investigators, Funkenstein and his co workers, and Moses, Daniels and Nickerson have carried out experiments in a somewhat similar fashion Allowing for the differences in the experimental circumstances, the results can be readily reconciled Funkenstein found "high output" responses when students were angry at themselves for poor performance in test situations but "high resistance" patterns when the students' resentment was felt toward the experimenter who was also an "authority" figure Moses found "high output" responses when anxiety was overt and fully expressed but "high resistance" patterns during intense rage or resentment or anxiety which was incompletely expressed (58, 146)

Attention was called to the fact that in essential hypertension there occurs a sustained increase in peripheral resistance without a rise in stroke volume There was not, however, a significant difference between hypertensives and normotensives in reactions to short term stressful situations Neither was there any correlation between an individual's response to interview and his reaction during a cold pressor test or between the type of vascular reaction to stress and the degree of vascular damage as reflected by the eye grounds heart size or kidney function

It was particularly notable that the mechanisms of the vascular apparatus responsible for raising the blood pressure in response to symbolic stimuli were not impaired by thoracolumbar or even total sympathectomy Either the "exercise" or "high resistance" pattern might still occur although no longer was there evidence of associated reduction in renal blood flow It is conceivable that the loss of renal vasoconstrictor activity may protect the kidneys and thereby have a salutary effect on the course of essential hypertension Perhaps it may be a factor in the apparent increased survival of sympathectomized patients even without notable reduction of arterial pressure

The significance of all these findings is not clear but there is nothing incompatible with the view that the life adjustments in individuals with essential hypertension involve initially renal ischemia which may in turn set off a variety of endocrine and other humoral mechanisms with the ultimate development of irreversable tissue damage In any case it is clear that stressful life experiences are sufficiently prominent among stimuli to elevated arterial pressure to warrant their serious consideration in the clinical management of patients with essential hypertension The evidence of emotional restraint and the calm exterior often displayed by these patients make it necessary for the physician to exercise special diligence and skill in uncovering meaningful life experiences and the attitudes and reactions associated with them

CHAPTER VIII

A SURVEY OF 114 PATIENTS WITH ESSENTIAL *HYPERTENSION FOLLOWED UP TO* EIGHT YEARS

IN THE previous chapter some aspects of the hemodynamics of hypertensive subjects were compared with those of normal individuals. This chapter will be concerned with the study of the *hypertensive patient as a whole, the course of his disease, and his* adaptive responses to people and events in his daily life.

One hundred and fourteen hypertensive patients have been carefully studied by the authors over a period up to eight years. Data on the classification of patients and the course of the disease were *analyzed and are presented in tabular form in Table VI.* Forty-six of the patients were men, 68 were women. Their ages, when they were first seen by the authors, ranged from 17 to 65. Most of them, however, were between the ages of 25 and 45 and the majority had had known hypertension for more than two years prior to their first visit. *A few had been known to be hypertensive for more than* 10 years. In half of the group, the discovery of hypertension was altogether fortuitous, occurring either in the course of a routine examination or during the investigation of *totally unrelated* symptoms. In slightly over half the diastolic pressure was 110 *or higher* when they were first seen in our clinic. In only 5 of the group was the diastolic pressure below 90 on their first visit. After the period of observation and treatment however, there were 27 with the diastolic *pressure below 90 and 47 whose diastolic pressure* was over 110. Fourteen of these patients lost all evidence of hypertension and 9 others were considered greatly improved. It is interesting to note that the patients who improved, with respect to the *level of* the blood pressure, were not necessarily in the young age group,

TABLE VI

Description of patients (showing case numbers) treated in the clinic (114)

1 Sex

Male 1, 2 9 12, 14, 15 16 17 21, 24, 27, 28, 29, 32, 38, 39, 42, 43 44 47 54, 55, 56 59 64, 68, 69 74 76, 77 82 84 85 86, 96 98 99 101, 103, 104, 105, 106, 107 108 113, 114 Total 46

Female 3, 4 5 6 7, 8, 10 11, 13 18, 19 20 22, 23, 25, 26, 30, 31 33 34 35 36, 37, 40 41, 45, 46, 48, 49, 50, 51, 52, 53 57 58, 60 61 62 63 65 66, 67 70 71 72 73, 75 78, 79 80 81 83 87 88 89 90 91 92, 93 94 95 97 100 102 109, 110, 111 112 Total 68

2 Race

White 1 2 3, 4 5 6 7 8, 9 11 12, 13, 14, 15 16 17, 18, 19, 20, 21 23 24 25, 26 27, 28 29 30, 32, 33, 34, 35 38 39, 40, 41 42 43 44 45 46 47 48 49 50, 51 52, 53, 54, 55 56 57, 58 59 60 62 63 64 65 66, 67 68 69 70, 71, 72, 73 74, 75, 76 79 80 81, 82 83, 84 85 86 88 89, 91, 92 93, 94, 95 96 97 98 99 100 102 103, 105 106 107 108 109 110 111, 112 113 114 Total 102

Negro 10 31 36 37 61 62 77 78 87, 90, 101 104 Total 12

3 Religions

Protestant 8 10 11 12 13 21, 22 24 27 29 31 33 36 37 40 56 57 61 63 67 75 77 78 79 81, 87, 90 101, 103 104 Total 30

Roman Catholic 2 7 19 23 35 43 44 47 50 51, 55 56, 62 64, 65 66 68, 71 73 74 80 82 83 85 88, 91, 92 93, 94, 97, 99, 102 106 107 113 Total 35

Jewish 1 3 4 5 6 9 14, 15 16 18 20 26 28 30, 32 34, 38, 39 41 42 45, 46 48, 49 52, 53 54, 58 59, 60, 69, 70 72, 76, 84 86 95 96 98 100 105 108 109 110, 111, 112 114 Total 47

Greek Orthodox 17 25 Total 2

TABLE VI (Con't)

4 Marital status

Single 6, 7, 8, 14, 16, 17, 27, 31, 32, 38, 42, 44, 45, 55, 67, 68, 73, 78, 90, 101, 105, 106, 109, 110 Total 24

Married 1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 15, 18, 19, 20, 21, 23, 24, 25, 26, 28, 29, 30, 33, 34, 39, 40, 42, 43, 46, 47, 48, 50, 51, 52, 53, 54, 56, 58, 59, 60, 61, 62, 64, 65, 66, 69, 70, 71, 72, 74, 75 76, 77, 78, 79, 80, 81, 82, 83, 84, 86, 88, 89, 91, 92, 94, 97, 98, 99, 102, 103, 104, 107, 108, 111, 112, 113, 114 Total 78

Widowed 22, 35, 37, 57, 96 Total 5

Divorced or Separated 36, 49, 63, 87, 93, 95, 100 Total 7

5 Generations in the United States

1st 6 9, 10, 11, 12, 18, 20, 26, 27, 28, 34, 40, 43, 45 47, 48, 49, 52, 53, 56 62, 65, 66, 81, 89, 90, 91, 95, 96, 99, 104, 107, 108, 110, 111, 112, 114 Total 37

2nd 1, 3, 4, 5, 7, 14 15, 16, 25, 30, 32, 38, 39, 41, 46, 50, 51, 54, 55, 57, 58 59, 60, 67, 68, 69, 70, 71, 72, 73, 76, 79, 80, 82, 84, 85, 86, 88, 92, 93, 97, 98, 100 105 109, 113 Total 46

3rd 2, 8, 13, 17, 19, 21, 22, 23, 24 29, 31, 33, 35 36, 37, 42, 44, 61 63, 64 74, 75 77, 78, 83, 87, 94, 101, 102, 103 106 Total 31

6 Age on admission to clinic († = patients who improved)

to 20 yrs 17†, 73, 109 Total 3

21–25 yrs 21†, 74 113† Total 3

26–30 yrs 2, 7, 8† 16†, 27, 38 44†, 55, 69 80 86, 93, 106 Total 13

31–35 yrs 4 15, 23†, 33, 37, 47†, 61, 67†, 75, 78†, 79 84, 90, 98, 101, 102†, 107 Total 17

36–40 yrs 1†, 9, 13, 14 25, 30, 31 36, 39, 42, 43†, 45 46, 48, 51, 58, 72, 76 85, 87, 88 99, 103†, 109† Total 24

41–45 yrs 3, 10, 11, 12† 19, 32, 35, 41, 52, 62, 63, 68†, 77, 95, 100, 112 Total 16

46–50 yrs 5, 6 18†, 20, 22, 26† 29, 40, 49, 50, 53, 56, 64, 66, 70, 71, 82 83†, 91†, 108†, 114 Total 21

51–55 yrs 24, 28, 54 59 60, 89, 94, 97 Total 8

56–60 yrs 57, 81, 104, 105 Total 4

61 yrs plus 34, 65, 92, 96, 111 Total 5

TABLE VI (Con't)

7 How hypertension was discovered

Symptoms associated with hypertension 1, 3 5, 7, 10, 12 13, 15 17 18 23 25 28 29 30 32 33 36 37, 39, 40 41 42 46 48 49 50 51 52 53, 56 57 58 61 62 64, 65 68, 69 77, 78 81, 82 83 84 87 89 92 93 97 98 100, 102 105, 109 112 114 Total 57

Symptoms not associated with hypertension 6, 8 11 19, 20, 22, 26 27, 31 34 35 43 45 54 59 60 66 67 70 71, 72 74 75 79 85 86 88 90 94 95 96 101 103, 107 108 110 111, 113 Total 38

Accidental 2 4 9 14 16 21 24 38 44 47 55, 63 73 76, 80, 91, 99 104 106 Total 19

8 Duration of known hypertension prior to study

to 2 yrs 1 7 12 16 17 27 28 35 38, 43 45 46, 47, 48, 50 52 57 58 59 60 65 66 68 70 72 74, 78 79 82, 93 95 99, 101 103 107 108 109 110 111, 113 114 Total 41

2 through 4 yrs 2 13 19 21 29 31 34 36 41, 54, 67, 70 77 80, 85 89 92 Total 17

5 through 7 yrs 1 14 15 18 20 22 30 32 37 39 44 49, 55, 62, 69 71 73 76 83 90 91, 94 96 Total 23

8 through 10 yrs 3 5 6 8 23 24 25 33 42 51 53 63 75, 81, 84 86 88 98 102 104, 105 106 112 Total 23

11 plus yrs 9 10 11 26 40 56 61 87 97 100 Total 10

9 Blood pressure (diastolic) when first observed

89 or below 8 14 69 80 99 Total 5

90 to 109 1 16 17 18 21 23 26 28 30 33 35 37, 39 41, 42 43 44 45 47 51 53 58 59 60 65 66 67, 68 70 72 73 74 75 85 86 88 91 92 93, 95 96 100 101 102 107, 108 111, 112 113 Total 49

110 and up 2 3 4 5 6 7 9 10 11 12, 13 15, 19 20 22 24, 25, 27 29 31 32 34 36 38 40 46 48, 49 50 52, 54 55, 56, 57 61 62 63 64, 71 76 77 78 79 81 82 83 84 87, 89 90 94, 97 98 103 104 105 106 109 110 114 Total 60

TABLE VI (Con't)

10 Blood pressure (diastolic) last reading (* = patients who died (9) *Numbers in italic* indicate blood pressure lower than on admission to clinic (46) **Numbers in bold face** indicate blood pressure higher than on admission to clinic (12) Numbers without marks indicate that the blood pressure remained in the same range (47))

89 or below *1 10, 16, 17, 18, 21, 23, 26, 29, 37, 41, 43, 44, 47, 58, 59 65, 67, 68, 74, 75*, 92*, *95, 102, 108, 112, 113* Total 27

90 to 109 *6*, **8**, *9, 12, 13*, **14**, *22, 25, 32, 34, 38*, 39, 42*, 45, *48, 49, 50*, 51, 53, *56*, 60, 66, **69**, 70, *71*, 72, 73, *79*, **80**, 85, 86, *87*, 88, 93, 96, *97, 103, 105*, 107, *110* Total 40

110 and up 2, 3, 4, 5, 7, 11, 15, 19*, 20, 24*, 27, **28**, **30**, 31, **33**, **35**, 36, 40, 46, 52, 54, 55*, 57, 61, 62, 63, 64*, 76, 77*, 78, 81, 82, 83, 84, 89, 90, **91**, 94, 98, **99**, 100*, **101**, 104*, 106, 109, **111**, 114 Total 47

11 Length of time patient under observation (* = patients who died (9))

Less than 1 yr 24*, 30, 38, 40, 45, 57, 65, 89, 92*, 94, 97, 104*, 110 Total 13

1 through 2 yrs 7, 8, 12, 32 33 34, 35, 42*, 46 50, 54, 55*, 58, 60 66, 72, 75, 77*, 78, 80, 82, 83, 86, 90 93, 96, 99, 100*, 101, 102, 106, 107, 109, 113 114 Total 35

3 through 4 yrs 4, 6, 13, 14, 16, 19*, 22, 25, 29, 53, 61, 68, 73, 74, 84, 88, 91, 103, 108, 111, 115 Total 21

5 through 6 yrs *3, 5, 9, 10, 15, 17, 18, 20, 21, 23, 26, 31, 43, 44,* 47, 48 51, 52, 56, 62, 64*, 67, 69, 71 76, 79, 81, 85, 87, 95, 112 Total 31

7 plus yrs 1, 2, 11, 27, 28, 29, 36, 37, 41, 49, 59, 63, 70, 105 Total 14

12 Grade of severity of vascular lesions on admission to clinic

0 1, 4, 5, 9, 11, 14, 15, 16, 17, 18, 20, 21 22, 26, 30, 32, 33, 35, 37, 41 44, 45, 47, 50, 51, 52, 53 54, 58 59 63, 66 67, 68, 69, 70 72, 74, 75, 79, 84, 85 87 88, 90 94 95, 97, 100*, 101 107, 108, 110*, 112, 113 Total 55

1 2, 6, 7, 13, 19*, 23, 25, 28, 29 34, 38, 39, 40 43, 48, 49 55*, 57, 62, 64, 71 73, 80 82, 86, 89 93, 102 103 106 109, 114 Total 32

2 3, 8, 10, 24*, 27, 31, 36, 42*, 46, 56 60, 61, 65 76, 78 81, 91 92*, 96 99, 104*, 105, 111 Total 23

3 77*, 98 Total 2

4 12, 83 Total 2

TABLE VI (Cont)

13 Grade of severity at last observation

0 1, 5 9 11 14, 16, 17, 18, 20 21 22 23, 29, 30 35, 37 44 47, 50 53 54, 58 59 63 66 67, 68 70, 72, 74 75 79, 88, 94, 95 97, 101, 102 103 107, 108 109 110, 112, 113 Total 45

1 2, 3 4 7 8 25, 26, 28 32 34 38, 39, 43 48, 49 51, 52 57, 71, 73 78 82, 84 85 86 89, 90, 91, 93 Total 29

2 6 10 12 13 27 36 40 41, 45 46 60 61 62 65 69, 76 80, 81 83 87 96 106 111 114 Total 24

3 15 31, 33 56 98 99 105 Total 7

Died 19, 24 42 55 64 77 92 100 104 Total 9

14 Status at end of study

No longer hypertensive 1 16 17 18 21 26, 29 43 44, 47, 67, 68, 108, 113 Total 14

Improved 8 12 23 78 83 91 102 103 109 Total 9

Same 2 4 5 7 9 10 11 14 20 22 25 27, 28, 30 34 35 36, 37, 38 39 46 48 49 50 51 53 54 57 58 59 60 61 63 65, 66, 70 71 72 73 74 75 76 79 81 82, 86 88 89, 93 94, 95, 96, 97 98 101 107 110 111 112 Total 59

Worse 3 6 13 15 31 32 33 40 41, 45, 52, 56, 62 69 80, 84 85 87 90 99 105 106 114 Total 23

Died 19 24 42 55 64 77 92 100 104 Total 9

15 Sympathectomy

Before study 18 45 83 Total 3

During study 3 8 10 11 12 13 106 Total 7

16 Patients with congestive failure 8 10, 19*, 42*, 61, 77*, 80, 83 87, 92* 104* Total 11

17 Causes of death *

Pulmonary embolism 92 Total 1

Cerebral accident 19 24 55, 64 Total 4

Coronary occlusion 77 Total 1

Suicide 42 100 Total 2

Congestive Failure 104 Total 1

* An additional patient (# 61) has since died of coronary occlusion

or among those with the shortest duration of known hypertension, or those with the lowest initial levels of blood pressure In 23 of the 114 patients the severity of the vascular disease increased as reflected in the eyegrounds, electrocardiogram, heart and kidney status Eleven developed congestive heart failure Nine of the patients went on to die, two by suicide

In agreement with the findings of Sheldon, the hypertensive patients were more square and muscular than average (77) They were nonreflective, displaying a taste for dealing with problems by action Nevertheless under relatively intimate and prolonged observation all of these patients gave evidence of having special difficulty with self assertion and the expression of aggression or anger In many of them there was indirect evidence, from dreams or other sources, of extraordinary underlying attitudes of violence coupled with a guilty fear of giving expression to that violence Contrasting with their underlying attitudes the overt behavior of these individuals was often one of appeasement They displayed a strong need to conform, to please and to keep the peace They felt the need to show prowess without exhibiting aggression and continually feared that they would not succeed in doing so In several of the patients this pattern was adopted very early in life in others it was abruptly assumed after some show of violence seriously frightened the patient

Many of the group exhibited signs and symptoms of excessive skeletal muscle tension From the standpoint of attitudes as well as circulatory physiology they were mobilized for combat but did not engage in it against the pertinent adversary Under a facade which was often affable and easygoing, they were tense, wary and suspicious afraid of committing themselves They were poised to strike, as it were, but withheld their punch with a guilty fear of its consequences Hypertensive individuals were found to take out their aggression in some vicarious way by excelling in sports or merely an excess of general activity or excessive eating They were prominently preoccupied with appearances and saving face Nearly all of these patients had difficulty in developing warm personal ties This, coupled with inability to throw themselves wholeheartedly into things because of fear and suspicion made it

difficult for them to believe strongly in anything or to derive real satisfaction in their accomplishments In general their attitudes toward people and events were cautious wary and tentative

In childhood most of them had been seriously frustrated in the process of developing individuality and in self-expression As children they were all unduly shy, they blushed easily and were rarely able to admit they were wrong Most of the married ones selected domineering mates In the backgrounds of the subjects were certain common circumstances which may have provided conditioning situations The mothers of many of them were stiff and domineering inclined to demand compliance, and withholding approval for failure to comply They especially refused to tolerate outbursts of anger Their children felt that they were forced to compete for affection and approval by being good Many of our hypertensives dealt fairly successfully with this challenge and managed for a time at least to consider themselves the one closest to the mother This accomplishment inevitably developed the feeling of strong hostility toward the mother which was suppressed with varying degrees of success but was associated with guilt Often with their rigid personalities and notable lack of warmth these hypertensive patients repeated with their children the patterns they had known in their own upbringing

In brief the hypertensive subjects often gentle poised and apparently easygoing were filled with aggressive drive which was tightly restrained by a need to please

In order to bring into focus whatever bodily characteristics and personality features might occur most commonly in association with the hypertensive reaction pattern we compared the 114 patients with essential hypertension to a group of 150 subjects suffering from chronic vasomotor rhinitis or bronchial asthma reported in detail elsewhere (78) These latter in general, were of a more linear build less square and muscular and less hardy They were found to display predominantly the attitudes and behavior of defense and nonparticipation in contrast to the often aggressive but thoroughly bridled striving of the hypertensive They were less preoccupied with pleasing but their attempt was to shut out rather than to deal with the noxious environment

Striking confirmation of this formulation of the general character and attitudes of the hypertensive implying his proclivity for meeting challenges with a pattern of tightly reined mobilization is found in Friedman and Kasanin's study of apparently identical twins, one of whom was hypertensive (79) They found that the nonhypertensive twin was the brighter and the stronger of the two and the better student in school He was more relaxed and satisfied He expressed anger easily and recovered rapidly from humiliation The hypertensive twin felt that he was at a complete competitive disadvantage with his brother and spent a great deal of energy and time in trying to please people He had no enemies but suppressed resentment and hostility and carried them within him for a long time *He worked extremely hard and was "successful"* but never felt much satisfaction in his day to day living

More recently, Flynn and his associates (80) and Sheldon and Ball (81) have also reported a study of identical twins, in this instance girls, one of whom developed hypertension Altogether similar to Feedman and Kasanin's experience, it was found that the hypertensive girl had felt herself at a competitive disadvantage with her sister all her life

It is interesting that from the standpoint of body build and detailed topographical characteristics, these girls fell into the region of Sheldon's schema where there is the heaviest concentration of hypertension (77) Significantly, when tested with the ballisto cardiograph, both girls showed a proclivity for developing under stress an elevation in blood pressure attributable, apparently, to an increase in peripheral resistance One of these girls, however, used this hemodynamic pattern only sparingly and was ordinarily normotensive The other had adopted it as a way of life The contrasting personality characterics of these girls, as derived from interviews and special psychologic tests including the Minnesota Multiphasic and Rorschach, are shown in Table VII

Other authors, notably Binger (82), Weiss (83) Alexander (84), and Saul (85), have described the personality reactions of hypertensive patients in similar terms Saslow and his associates confirmed the abnormally low capacity for self assertion of hyper tensives in an elaborately controlled statistical study of person

TABLE VII

Contrasting attitudes and reactions of identical twin girls, age 21

E was hypertensive and K was normotensive

Personality Features	
E	K
Outwardly placid, poised and compliant	
Qualifying cautious tentative	
Tense anxious sensitive	More relaxed
Lacks self esteem and self confidence	More confident
Placates and lacks self assertion	Normally aggressive and self assertive
Suppresses and represses emotions	Expressive
Over dependent and passive	
Depressed	Optimistic
Lacks satisfaction from activities	Normal satisfaction from activities
Bodily concern and concern over heterosexual adjustment	*Bodily concern and concern over heterosexual adjustment*

ality (86) Harris Sokolow and associates compared the results of a psychological study of 40 young women whose blood pressures exceeded 140 systolic or 90 diastolic or both with similar data from 40 women whose blood pressures were less than 120/80 In the stressful situations the prehypertensives behaved less effectively were less effectively assertive less poised and they created less favorable impressions socially than the controls In psychiatric interview they responded similarly to patients with clinically diagnosed hypertension (87)

The tendency for hypertension to be found in families where other individuals also have the disease is well known, and among our group approximately half knew of hypertension having existed in other members of the family

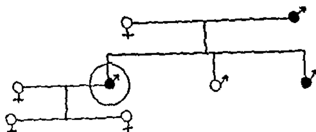
It is interesting to compare the findings in the present series

with those of Griep and associates who followed 117 patients with essential hypertension for 8 to 10 years (65) Approximately half of the patients were still alive at the end of this time Half of those who had died had succumbed to cerebrovascular accidents, the other half to congestive failure, coronary occlusion or renal complications They found that 80 per cent of those who showed cardiac enlargement, electrocardiogram changes, albuminuria or encephalopathy were dead at the end of the 10 year period of study Retinal changes and blood pressure levels seemed to be of far less prognostic importance and the symptomatology apparently had no bearing on survival

Following 500 patients with essential hypertension all the way to death, Perera found that the life span from the time of discovery of the hypertension varied from 1 to 40 years with an average survival time of nearly 20 years (88) The cause of death could not be determined in 43 per cent of his patients Twenty two per cent died of congestive failure and only 9 per cent of cerebrovascular accident

Twelve patients who are thoroughly representative of the group of 114 were selected for description in some detail although available space will not permit presentation of the full data The patients selected were those observed most closely and consistently over a substantial period of time and whose account of life experiences was reasonably full Five are men, 7 women They ranged in age from 17 to 55 at the time they were first seen by the authors Hypertension was originally discovered in the second decade in 1 of the patients, in the third decade in 4, in the fourth in 3, and in the fifth in 4 Five of the 12 patients 3 men and 2 women, showed striking improvement with return of the blood pressure to normal in a setting of learning to express themselves more freely, especially with relation to anger and aggressive attitudes Two of the group died, their cerebral hemorrhages having occurred shortly after a major frustrating event in which the patient was unable to react with any degree of adequate self expression This is particularly interesting in view of the report by Ecker (89) in which 20 instances of "stroke" followed a major frustration or situation in which anger could not be expressed adequately

CASE 15 *A rigid young man with deeply repressed hostilities and very little insight No improvement in his still labile hypertension after six years of clinic visits**



The patient was a swarthy, obese man with a black moustache He had an energetic walk reminiscent of a rubber ball and showed obvious tension as he sat stiffly on the edge of his chair He was born in New York City in 1912 His father and mother came to New York from Russia in their early teens

The father a lenient and kindly 'old fashioned man complained much of the time of poor health and was never a good economic provider Neither was he forceful or aggressive He left all decisions up to his strong willed wife who was four years his junior He had developed hypertension at an early age with cardiac and renal involvement but survived until the age of 64 finally dying of a succession of strokes

The patient s mother was a stubborn and persistent woman who suffered from asthma most of her life She is definitely the boss ' said the patient I don t see how the old man could stand it ' The patient got on well with his father but his mother displayed an obvious preference for another son two years younger than the patient a tense, seclusive boy who during World War II was rejected by the draft because of nervousness The two boys had relatively little to do with each other

A second brother 14 years younger was described as a slow moving easy going fellow who did well in the Navy Air Corps during the war He never married but remained at home to support his mother after his father s death He ultimately developed hypertension and in 1953 his blood pressure was reported to be 240/130

The patient s birth and early development were not unusual When he was 5 years old his mother developed tuberculosis During a period of

* In this and subsequent diagrams the blackened symbols are known hypertensives The patient s symbol is circled

one and one half years which she spent in a sanatorium, the patient and his brothers lived with an aunt and he never recalled missing his mother Shortly thereafter he spent six months in a preventorium His memory of this period was very faint

His first year at school at the age of 6 was difficult but thereafter he did very well He skipped several grades and was always able to stay near the top of the class without working very hard He liked school and got along well with the teachers and students alike School, no doubt, represented security to him because his outstanding memory during the whole grammar school period was fear of going home from school every day He never knew who was going to be sick when he got home—his father with his hypertension, or his mother with her asthma In addition, although the family was never hungry, there was never any real financial security

After finishing grammar school he went on to trade school 'By then I was a wise guy I cut my classes " He did only fairly well and at the age of 16 quit school to go to work "I have always been terribly ambitious, not for dollars and cents, but for position " He felt held back at school and impelled to go to work because of the chronic poverty at home For the next eight years he had various jobs beginning as a shipping clerk and then working in the upholstery business He did well and saved money, so that by the time he was 24 he had established himself in his own shop

One and one half years later, at the age of 25, he married a girl, four years younger than himself, whom he had known for four years She was a jovial, good natured woman with a background similar to his She never got along well with her parents and it was always at the patient's insistence that she maintained contact with them

The patient had obtained his early sexual information from the boys at school, the subject was never discussed at home At 16 he began masturbating intermittently for about one year but this never caused him any particular concern Also, at 16, he had his first heterosexual experience This was arranged with a prostitute by his boss, who "wanted to introduce me to the facts of life I was scared to death, I couldn't do any good " He did not try intercourse again for two years but at the age of 18 he began having fairly frequent intercourse with girls he encountered on the street This behavior continued until he was married His wife would not permit intercourse during their four year courtship He never acknowledged feeling guilty concerning his sexual activity

After marriage he concluded that his wife had "queer ideas" about

sex I had to chase her for a week on our honeymoon' before sexual relations were accomplished After this intercourse became moderately satisfactory to both until after the birth of their first child, a boy two years after their marriage Following her pregnancy his wife developed a profuse growth of dark hair on her face became "moody' and 'let herself go to fat Their concern about this led to endocrinologic studies but results were entirely normal The hair was gradually eliminated by electrolysis over a period of the next 10 years Nevertheless, the patient's wife apparently lost interest in sexual relations frequently refusing them on the grounds of fatigue or a headache "I used to resent that but I've gotten over it said the patient He resumed his relations with girls from the street occasionally forming liasons lasting a year or more These affairs gave him a feeling of being wanted and helped him to ignore the rejection implicit in his wife s refusal to have more frequent relations with him Instead of feeling guilty he said, On the contrary, it's a good thing it helps me leave my wife alone'

Seven years after their marriage a second child a daughter was born Both children were planned and wanted but the responsibility of caring for child en did not improve his wife s disposition As her irritability increased the patient's feelings toward her became ambivalent He began to see a similarity between his mother and his wife but' my wife is much the better mother of the two She is a wonderful woman and nobody could take her place in my life her faithfulness vivacity, devotion to the children ability to make friends In the next breath however, She is not as good with the children as she could be always shouting at the boy I try to explain this to her, but she doesn t seem to under stand She has never been quite like I hoped As a boy I never got any love so I kind of hoped my wife would make love to me but she never did That s why I prefer other women [in sexual relations] because they will take the initiative

The patient was brought up in the Orthodox Jewish faith but it was never of great importance to him He and his wife observed the holy days and some of the rituals in a perfunctory way

Frustrated in his home life the patient threw all his energies into his business He was continually concerning himself with ways of making more money At about the time his first child was born when he was 27, one of his enterprises failed In this setting he developed a 'sinking feeling as though everything was running out through my arms and legs A physician told him he had hypertension A second physician, consulted the following day denied the hypertension and advised him to forget about it He was able to do this for a few years and even passed

several physical examinations for life insurance without questions being raised about his blood pressure However, at 32, during the stress of another shaky business venture, and at the time of the birth of another child, he began to note increasing tension, restlessness, and difficulty in concentrating At this time numerous physicians found his systolic pressure in the range between 165 and 180 He became conscious of a tight feeling around his head, in his throat, and in his chest, and of a beating of his heart whenever he was still, especially in bed at night Once when *his 1½ year old daughter toddled up to him he had a sudden urge to* strike her Terrified at such an impulse, he began to lock himself in the bedroom at night On another occasion when a boy of 12 or 13 threatened to molest his wife in the street, he picked the boy up in a sudden rage and threw him down to the sidewalk Again he was horrified at his uncontrolled behavior

The only relaxation afforded him was drinking liquor in the evening away from home, but he felt that this provided no real solution to his problems At night he was usually able to sleep well, only occasionally waking with a transient feeling of tension Further symptoms developed, however, with epigastric pain and belching With these complaints at the age of 34, he first came to the New York Hospital Physical examination revealed no abnormalities except for blood pressure 162/100 Chest x ray, electrocardiogram and renal function tests were unremarkable

The patient attended the clinic regularly for one and one half years and during the ensuing four years returned irregularly at our request

Aside from eliciting the history, most of the visits were taken up with a recital of symptoms, which were numerous and varied He was encouraged to express his feelings freely and was given frequent strong reassurance His periods of tension and depression became shorter and less frequent His blood pressure during the first year and a half varied little It was apparent that he had a great deal of hostility and resentment but this was never mobilized or focussed on its object Occasionally he found *that punching a punching bag would afford transient relief of tension*

Two years after his first visit to the clinic his father died of a stroke The patient was able to take the responsibility for arranging the funeral without an undue grief reaction and without significant aggravation of his symptoms His blood pressure remained unchanged

On several occasions the patient dreamed of his wife s doing something he disliked or disapproved of In the dream as in real life, however, he did not lose his temper and never did more than indicate disapproval

His behavior was similarly unaggressive with business partners Once

when he was berated for three hours by a partner, he found himself unable to return the hostility "What could I do? So I just laughed at him"

Sodium Amytal administered intravenously on three occasions, failed to change his blood pressure materially

In the summer of 1949 the patient began visiting the local physician who had cared for his father He received reassurance from this friendly, sympathetic man once every week or two and came to the clinic less and less frequently It was of interest that the blood pressure readings obtained in the office of the physician were always in the neighborhood of 138/90 while those recorded in the clinic varied from 145/100 to 170/120

Throughout the next four years blood pressure recordings in our clinic rose higher and higher being 190/120 in 1951 and 225/125 in 1953 His local physician however continued to report blood pressure readings in the neighborhood of 140/90

When last seen in June 1953 he was still unable to get angry "I have good control of myself He had gained 26 lbs in weight and was now frankly obese Physical examination was essentially unchanged, except for further narrowing of the retinal arterioles The electrocardiogram showed progressive changes in the T waves indicative of left ventricular hypertrophy

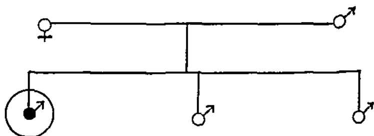
Nothing in his life seemed to have changed Recurrent business crises continued and he continued to feel a lack of emotional support at home All in all he gave the impression of a man sitting on a powder keg trying to convince himself and others that he was relaxed and without a care in the world

Summary A 34 year old upholsterer born in New York of Russian Jewish parents experienced insecurity as a child which was fostered by chronic illness in his parents and his mother s rejection of him in favor of her second born son Always anxious for support at home and never getting it from his weak father or his rejecting mother he quit high school at 16 to go to work in an attempt to establish independence He pushed himself constantly to achieve not only economic security but also a position in life At 25 he married a woman who was a good deal like his mother She became depressed and rejected his sexual advances In a setting of business failures in the face of increasing responsibility at home he developed a multitude of symptoms which led to the discovery of hypertension at age 27 The blood pressure apparently fell to normal for five or six years rising again in a similar setting when the patient was 32 After coming to the clinic he talked freely with his physician and

soon became aware of intense hostility and resentment, which he had difficulty controlling On one or two occasions, when he did express hostility, he felt guilty and panicky, fearing that he might hurt someone Accordingly, he continued to suppress his feelings

After one and one-half years he stopped coming regularly to the clinic During follow up visits, however, his blood pressure was found to be rising as evidences of retinal and cardiac changes developed Blood pressure readings recorded in the office of a friendly, reassuring local physician were uniformly much lower than those in the clinic

CASE 16 *A repressed young man who lost his evidence of hypertension as he achieved an increased measure of self confidence and capacity for self assertion*



The patient was a neatly dressed, moderately obese, pleasant, yet tense young man of 27, the eldest of three sons of Orthodox Jewish parents His father was a quiet, hard working clothes cutter, who deprived himself for the benefit of his family Born in Russia and coming to the United States at the age of 10, he received little formal schooling, but was self taught and well read He always felt close to his father, yet never felt able to discuss personal problems with him

His mother was born in New York City of Russian born parents A nervous, domineering, overprotective woman, she was easily aroused to anger The patient felt able to talk to her concerning his problems, but resented her overprotectiveness

The two younger brothers were quiet, easy going but ambitious, and contributed, with the patient, to the family support He resented their easy acceptance of their mother's services and protectiveness

The patient's birth in the Bronx was normal His memories of early childhood were vague ' but I don't remember any unhappy times " He never presented a feeding problem as such, but food early became and remained a source of conflict between him and his mother She expected him to eat all the food she put in front of him and overrode his ineffective protests by making his compliance a demonstration of his love for her

Similarly she would interpret his refusal to eat as a rejection of her causing him to feel guilty and resentful He was overweight from early childhood and it was not until some discussion of this problem took place in the clinic that he was able to refuse his mother s food He then lost 30 pounds in three months

At age 6 he began school and consistently did well "Yes, I think I liked it he remarked of school with characteristic hesitation He got along well with all his teachers except one and got along equally well with his contemporaries Throughout his childhood he had only one fight and this he lost He had a recurrent dream of being a small child in a large hall with a marble floor which echoed Everything seemed very large to him and he seemed very small The insecurity, manifest in this dream may explain in part his desire to do well in school and his lack of self assertion because it might involve conflict

At 13 he graduated from grammar school with excellent grades and he went on to finish high school near the top of his class Drafted into the Army he rose quickly to the rank of sergeant, and did service as a flight engineer aboard B 25 bombers in the Mediterranean Theater dur ing the war After 2½ years and toward the end of the war, he became nervous irritable and depressed He developed headaches, for which he sought no help while in the Army but because of their persistence after his discharge he sought help from the Veterans' Rehabilitation Clinic After four therapeutic interviews his symptoms were gone He entered college majoring in Industrial Arts with a view to teaching in the Public Schools of New York City He did well academically but at the end of the second year his father died suddenly of a heart attack ' He was one of the best men I ever knew One year later at the age of 25 the patient took a physical examination for an appointment to a city teaching posi tion He was failed because of a blood pressure of 160/90

Sexually he was shy and inhibited At the age of 14 or 15 he began masturbating but for a long time I did not know what I was doing " He had no sexual information from his family but obtained most of his knowledge from lectures given in the Army He had no feeling of guilt concerning masturbation and considered it a natural way of relief in the absence of other opportunities He never attempted sexual relations

Though encouraged by his mother and father to have dates with girls, and though attracted by girls while in high school he always felt too embarrassed to ask for a date I wanted to have dates with girls, but I didn t know how to go about it Finally in the Army he began a cor respondence with a girl through a mutual friend This blossomed into

his first date, which, however, he was too embarrassed to enjoy The second date he did enjoy, and from that he progressed to enjoy kissing and necking He never considered himself in love, was always afraid that the girls would get too interested in him, and that he would have difficulty disentangling himself Because of his fear of hurting them he remained tentative in his relations with them, and would frequently go many months without having a date

After his father's death, the patient felt guilty about leaving his mother at home alone, and this interfered further with his dating activities On one occasion he was invited to the country for a weekend with another boy and his girl, with the idea that he also bring his girl "I took my mother along because I didn't feel right about leaving her home I imagine I shouldn't have taken her" A simple discussion of these matters, during his course in clinic, alleviated his sense of guilt Weekends in the country without his mother became easy for him, and he was even able to break with a girl who said she loved him, without feeling guilty

The patient was brought up in the Orthodox Jewish faith, but his heart was never in it, and it was always apparent to him that his father's heart was never in it either His definition of God was 'a word for whatever is unknown, as it becomes known it is no longer God" His mother professed to be religious, but he merely considered her hypocritical in her views He disregarded her protestations

A routine medical history was remarkably benign He had had no serious illnesses There was a tonsillectomy at age 1, and an episode of 'sinusitis' at age 8 At 14 he developed hay fever with symptoms in the spring and fall A systemic review was negative except for the tendency to obesity The family history included heart disease in the father, a transient episode of hypertension in the mother, diabetes in a grandmother and hay fever in a brother

Physical examination showed blood pressure 150/100 pulse 80 He was moderately overweight The optic fundi showed slight tortuosity of the arterioles, but no narrowing or arteriovenous nicking The heart was not enlarged Rhythm was normal A2 equal to P2 After exercise there was a presystolic rumbling murmur The peripheral pulses were all present and of good volume The remainder of the examination was unremarkable It was felt that the patient had an asymptomatic mitral stenosis in addition to his hypertension and that his cardiac classification was 1A

Routine laboratory work was normal There was no cardiac enlarge-

ment by x ray, and the electrocardiogram was normal except for right axis deviation

Course The patient was seen in the clinic 13 times with an additional follow up visit two years later At the beginning of each interview the blood pressure was taken in the supine position the lowest of several consecutive readings being recorded

After obtaining the history which is elaborated above, specific topics of emotional significance in his life were discussed It was easy for him to talk of his problems, which divided themselves into three categories his hostile yet dependent relationship to his mother his self-consciousness particularly with regard to the opposite sex, and his tendency to be perfectionistic He was able to profit by discussion and reassurance and was able to accept suggestions for altering his behavior Of the interviews he said I always feel better when I leave"

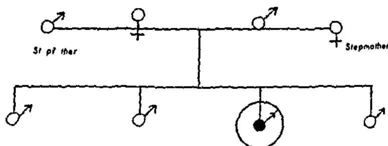
The emotions, secondary to the patient s relationship to his mother seemed the most pertinent to his hypertension particularly as these were intensified by the death of his father He frequently became angry with his mother yet was unable to express his anger Indeed he tried to suppress his anger from consciousness, because feeling angry, particularly at his mother made him feel guilty For the most part he was successful, but minor controversies with his mother could make him moody and depressed for days at a time His mother had a habit of asking him to do things around the house just when he was about to leave for school or some engagement This always made him angry yet he would feel too guilty to refuse In situations of this sort he was encouraged to express his anger One morning his mother asked him to move the furniture just as he was walking out of the house to keep an appointment He told her with considerable temper that she ought to ask him to do these things before he started to go out and that he would move the furniture when he returned He went off for the day without feeling guilty, and more important without the necessity for suppressing anger Later he reported when I get mad at my mother I yell and then it is all over

Four months after coming to the clinic he passed his physical examination with a normal blood pressure and was given his license to teach in the Public School System At a follow up visit 2 years later his blood pressure was still normal

Summary In this case there was the very common problem of a boy growing up attempting to achieve independence from his mother The

overprotectiveness of his mother, as well as his own dependent needs, evoked hostility and resentment in him, which he was unable to express and which, in turn, evoked guilt Suppression of resentment was his means of achieving emotional tranquility, but this was associated with brief periods of depression, and with the discovery of hypertension Through direct expression of anger his store of suppressed resentment was released and his blood pressure returned to normal Through encouragement and reassurance he was able to feel and to be more independent, thus minimizing guilt and resentment, which had been a corollary to his feeling of dependence The change in his status from that of a college student to that of a teacher earning his own living contributed to his sense of independence and satisfaction Blood pressure reverted and remained normal

CASE 17 *An earnest, conscientious 17 year-old boy rejected by his mother and father was found to have hypertension on a routine physical examination undertaken because of difficulty in concentrating and deteriorating performance in school With reassurance he was able to establish emotional independence and became normotensive*



The patient was a slim, dark, clean cut boy of 17 with a gentle voice and a tense, bashful manner He was the third of four sons of Greek parents His two older brothers were nine and seven years older than he, the other was six years younger than he He remembered his father as a likeable, broad minded, helpful man, with a sense of humor, but who continually shook the family s equilibrium by spending much of his time in the company of a woman in the neighborhood This led to bitter disputes between his parents

The patient s earliest recollections at about the age of 6 were of attempting with his older brothers to establish peace without taking sides The patient remembered especially being upset seeing his mother cry She was a dour, humorless woman who was intensely religious (Greek

Orthodox) and very disapproving of her children's minor misdeeds The boy had frequently recurring and terrifying dreams of being pursued In some of his dreams the furnace came to life or the hot water heater took the form of an animal with a grotesque mouth, ears nose and eyes He once dreamed of falling through a toilet and woke up with his bed wet He had no recollections of toilet training but does recall that he was severely punished for this lapse

By the time he was 8 years old his parents were divorced The patient lived with his mother She would not allow him to answer letters from his father who had married the other woman' His two older brothers went to live with the father while the patient and his younger brother remained with the mother

The mother had difficulty supporting herself and her two small children in New York She complained a great deal and the patient tried his best to please her by getting excellent grades in school When the patient was 13 years old his mother married a Greek chef 'At first he was all right said the patient 'but soon he began to get mad at every little thing even if I left a shirt lying on a chair" Within a year or two the patient and his step father were not speaking to each other, and the boy got less and less support from his mother On one occasion, for example, a guest came to the house and took off her ring to play the piano The ring disappeared and the patient was accused of stealing it Some months later it was found in the piano but no apologies were made to the patient The atmosphere of the household was that of an armed truce This did not seem to disturb the step-father greatly, but for the patient, a dependent compliant child who disliked any show of anger, the situation at home became intolerable Nevertheless feeling that his step father was making his mother happy, he tried hard to pretend to himself that things were as they should be He redoubled his efforts at school and in addition at 14 he got working papers for a part time job after school as a delivery boy for a florist shop In this job he worked 6 to 8 hours a day after school and 12 hours on Saturdays and Sundays

The same year he entered high school and was able to keep his high academic standing for one year Thereafter his performance at school began to deteriorate although he was still able to get passing marks I couldn t concentrate I don t know why I like school I m thinking of the work but it just doesn t sink in any more I try to remember, but I can t

At 15 he changed jobs and became an usher in a movie theater from 7 to 12 P M seven days a week I was short on sleep but it didn't

bother me" A year later he changed his job again to work in a drugstore from 6 to 10 P M

He gave most of his earnings to his mother, who bought him clothes and things he needed "The rest I spent foolishly on shows and things I did not need"

With a little spending money in his pockets the patient began evincing some interest in the opposite sex He had begun masturbating by himself at 14 or 15 "At first I felt guilty," but by the time he was 17 he was able to say, "Now I think it is normal" After a few affairs of 'puppy love," at 16 he had his first experience with sexual intercourse and from it contracted gonorrhea He was ashamed of this and did not like to talk about it

By the time he reached 17½ years of age he was very unhappy School was going badly and he could barely keep passing grades Work outside school was not interesting or rewarding and he did not feel like continuing to work He received no support, interest or encouragement from his mother or his step father, indeed he was happier out of the house than in it His attempt at an adult heterosexual relationship had ended in gonorrhea Where could he turn? He had no energy for work or for school, he was unable to sleep at night and felt continually tired His cheeks and ears began to flush several times a day his hands and feet began sweating constantly He waked every morning with a dull, throbbing headache which disappeared after an hour He developed dizzy spells, fell asleep in class at school, felt hungry all the time but could never satisfy his appetite After he had gained 10 lbs in a period of two months he lost his appetite and the weight He began feeling short of breath with exertion At night, when trying to fall asleep he felt as if he were smothering His heart would begin to race for periods of 5 to 10 minutes several times a week without apparent cause He noted a throbbing sensation in his throat and pain in his left hip

He occasionally tried drinking but six drinks made him sick and left his problems unsolved

In this situation he could think of only two ways out One was to leave his home and go to Chicago to stay with his father He knew his mother would object to this and he did not want to hurt her The other was to join the Merchant Marine, but he wanted to finish high school first He had to talk to someone so he went to his family physician who told him his blood pressure was 180 and referred him to the New York Hospital for treatment Thus at the age of 17½, entirely on his own and without

the knowledge of his mother, he came, telling the registrar at the clinic that he could get no financial help from his mother to pay his clinic fees On his first visit his blood pressure was found to be 162/10) The remainder of the physical examination was unremarkable

The urinalysis was normal a Wasserman negative, the electrocardiogram normal without axis deviation An x ray of the chest was normal without evidence of cardiac enlargement Psychometric examination showed high average intelligence with anxiety

After a few visits to the clinic in which he was given a hearing for his troubles and sympathetic encouragement he decided to visit his father in Chicago Before he left his blood pressure had fallen to 118/60 He enjoyed seeing his father and step mother who treated him very kindly His symptoms disappeared After three weeks he returned to his mother's house Soon he found himself back in the same old rut again with fatigue lack of vitality and inability to concentrate His blood pressure was again elevated

Having had a glimpse of what he thought would be a happier home life in Chicago he became preoccupied with the idea of living there permanently His mother objected however He felt guilty for a time 'I d be sorry it I never saw her again I love her I don t know whether it is right or wrong to go back to Chicago Some of his friends told him he should go back to Chicago others told him he should stay His mother's friends told him it was terrible that he had even paid a visit to Chicago Nevertheless within two weeks after returning to New York he informed his mother that he intended to live in Chicago Her only comment after an initial silence was After I ve brought you up now you re going to leave She repeated this over and over and the patient merely responded I don t want to stay here I'll be happier in Chicago After two or three days of this his mother agreed to his leaving if he paid the fare himself His step father said nothing His father when notified was happy to have him

The move to Chicago was not a success He found that his father and step-mother were quarreling constantly and had decided to get a divorce In school he was able to concentrate better but was not able to attain his former high standards In June of 1949 at the end of the school year he went to work in a factory His father insisted on having the boy s entire earnings returning to him now and then a small amount of spending money The patient tried unsuccessfully to induce his father to let him keep half his salary The step mother stayed out of the argument

but was sympathetic to the patient, as was his older brother who felt that they both should leave the father's home The patient said, "But I'm trapped either way, so maybe it doesn't make any difference"

In any event, he returned to New York in August of 1949 with a plan to join the Navy for three years, to get his high school diploma while in the Navy, *and then to carry out his original plan of going to the Merchant Marine Academy*

Upon his return to the clinic he said, "In a way I feel that my blood pressure is down (it was 135/70) because I don't feel the same way I don't have headaches at all I don't feel tired or lazy I don't feel dizzy *I can concentrate better*"

One week later he took a physical examination for the Navy He had no difficulty with his blood pressure but was failed for orthopedic reasons, one hip being higher than the other He was therefore examined in the Orthopedic Clinic of the New York Hospital where it was felt he had a *mild idiopathic scoliosis of the lumbar spine* Straight leg raising was limited on the left and with the history of pain in the left leg the possibility of a ruptured intervertebral disc was entertained

Having been turned down by the Navy, he then tried the Merchant Marine but was refused because of a blood pressure of 140/90 A few days later in the clinic it was 136/74 *He tried several more times to pass* the Merchant Marine physical examination Each time blood pressure was normal but he was turned down because of an elevated pulse rate *Despite these setbacks, he felt more sure of himself and was able to sleep better* He felt certain that he would eventually pass the physical examination He took on a job as a delivery boy until such time as he would pass the physical Finding that his concentration had improved he began studying physics on his own During this period (September 1949) he was seen twice in the clinic the blood pressures were 134/65 and 126/68, and the pulse rates were 68 and 72

In December 1949 the Merchant Marine examiners advised him to wait six months and to reapply The prospect of having to live with his mother and step father did not please him particularly as they were *taking two-thirds of his salary An opportunity arose,* however for him to live with a friend out of town After one week's debating with himself and one visit to the clinic he made up his mind and left home "The main thing is I want to be independent I don t want to have anything to do with relatives or anything"

Shortly after he left home his brother came to New York and asked the patient to accompany him to Arizona In the meantime he had given up

the delivery job and had returned to the florist shop where he was working from 8 A M to 9 P M Arizona seemed to offer a better way to pass his six months waiting period before joining the Merchant Marine, so he went In many ways Arizona agreed with him He returned to school and did part time work after school He gained 15 lbs in weight His only difficulty however was the pain in his left leg which had plagued him before and which now returned worse than ever It finally incapacitated him for work being severe with coughing straining or lifting It radiated from the left hip down the back of the thigh to the internal malleolus Accordingly he returned in April 1950 to the New York Hospital to which he had always returned before when in trouble

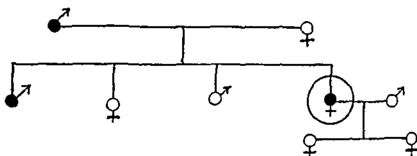
On this occasion, it was felt more definitely that the patient had a herniated intervertebral disc straight leg raising being limited to 10°, but there were no other neurological changes He was advised to try three weeks of bed rest at home flat on his back, which he agreed to do After five days in bed he became extremely restless (I just get nervous) His leg became better Life with his mother and step-father was no more pleasant than it had been in the past even though he felt able to express anger toward his mother and to talk back to her

He decided to have another try at getting into the Navy and despite the trouble with his leg he passed the physical examination with normal blood pressure and pulse The last word was received from the patient s medical officer after two years of service He had been well, and his blood pressure was 120/70

Summary This is the story of a 17 year old school boy who was discovered on a routine physical examination to have hypertension He was a child of a broken home with a nagging mother and a hostile step-father who had stopped talking to him two years previously He wanted to be independent but his youthfulness kept him dependent on his mother He had a good deal of resentment against his mother because of her nagging and her lack of help and understanding Any expression of his resentment made him feel guilty In this setting in addition to the development of hypertension he developed hot flushes poor sleep inability to concentrate headaches and chronic fatigue

The clinic gave him an opportunity to talk about his problems Merely talking over his problems with a sympathetic listener allowed him to make decisions which in effect helped him assert his independence of his mother In feeling more independent he was able to express his feelings of resentment without feeling guilty and blood pressure rapidly returned to normal

CASE 18 *A 46 year old Russian Jewish immigrant whose values of schooling and social prestige were frustrated in a marriage to an unambitious husband With a reorientation of attitude and recognition of her husband's assets evidence of hypertension disappeared*



The patient was a neat, well dressed, slightly obese but attractive woman with gray hair which was carefully tinted Her speech was softly modulated, her manner was ingratiating and placid although she gave the general impression of discontent She had been born in Russia, the fourth of five children Her mother was an uneducated, quiet, self-effacing woman who allowed her husband to dominate the household He was a lawyer who was intensely eager for his children to excel in school and to be educated for "the professions" The three older children, two sons and a daughter, became a lawyer, physician and dentist, respectively The daughter who became a dentist was the father's favorite and the patient competed with her for his attentions by telling him stories, often imaginary, of her playmates threatening her or of traumatic episodes she had witnessed She made a great effort to excel in her studies but somehow she felt her father did not respect her abilities Soon she turned this into a poor opinion of herself She could not even tolerate having pictures made of herself Many years later she found an old picture of her graduating class taken when she was 13 Her picture was distorted by a moustache and lines through her eyes making it unrecognizable "I must have done that myself though I have no recollection of doing it"

At the age of 11 she began menstruating She was frightened by her first period Though she told her mother and older sister about it, she tried to conceal the fact of her menstruation from other girls She did not know what it meant except the slight information she received from her mother—that it meant being a woman 'I never liked being a woman I always wanted to be a man"

She had completed one year of medical school at age 19 when the

family immigrated to the United States because of the Revolution in Russia After arriving in the United States she kept up a correspondence with a young man with whom she had fallen in love in Russia Finally her father began to intercept and destroy her letters a fact that she did not discover until some months later Because the study of medicine was impossible for her to continue in the United States she decided to take up nursing For financial reasons she took a one year course in practical obstetric nursing and forever after blamed herself for not even becoming a registered nurse Her feelings were enhanced by the knowledge that her father considered nursing a debased profession,' akin to domestic service

The patient who was brought up in an Orthodox Jewish home expressed her religious beliefs as follows ' To me religion is the Ten Commandments and brotherhood I cannot visualize God as a Being—but more as nature, or that which Man cannot create

At 21 she met a man one year younger than herself to whom she became engaged He also came from Russia but had not enjoyed her educational advantages Her father objected strenuously to her marrying this man because of his limited schooling but she persisted in her plans

The patient had no knowledge of sexual matters when she was married other than what he had learned in nurse s training It took her three years of married life to become adjusted to sexual intercourse The pain she experienced at first gradually subsided and she learned to enjoy intercourse with orgasm most of the time though it was never an activity about which she felt enthusiastic In her early 40 s she began having menorrhagia She was told by her physician that this was emotional in origin but no attempt was made at that time to investigate her emotional state At 42 menopause was induced by radium and her sexual desire which had been diminishing ceased entirely From then on she participated in sexual relations about once a week only for the sake of her husband A man needs a sexual outlet and he has been very good to me

After her marriage she planned to keep up with her nursing activity which he enjoyed Nursing gave her contact with people and a feeling of importance Her mother and husband however who felt otherwise conspired together and destroyed all her uniforms and nursing equipment She resented this intensely but never expressed her feelings on the matter directly Despite this she continued to do some nursing in her neighborhood more as a service to her neighbors and a source of satisfaction to herself than as a means of earning an income Frequently she

was not paid for her services and stated that she did not care whether she was paid or not It seems more likely that she was punishing herself for being what she considered a failure i e, a marriage disapproved of by her parents, and a professional activity lower than the medicine to which she and her father had aspired for her

One year after her marriage her husband lost his business and became a cab driver She was ashamed of this and accordingly told her parents that he had become a traveling salesman She kept up this deception for four years until her husband obtained a job as a movie projectionist This, however, was only a slightly more respectable occupation than cab driving in her parents' eyes

At first the patient was impatient with her husband for not getting ahead, but felt that his good qualities made up for his lack of success Indeed, in later years, she was glad that he had the time and patience to take care of her, which his job as a movie projectionist afforded him

Four years after marriage her first daughter was born Delivery was difficult, required instruments and was complicated by a post partum hemorrhage The child was born with bilateral branchial cysts which drained persistently and soon became chronically infected The patient was sure there was something wrong with the baby but was told by her physician that the girl simply had a dirty neck After one year the physician agreed that there were sinuses in the neck but said they would heal As the little girl grew older and played with other children she acquired the nickname "dirty neck" which was very distressing to the patient

When the patient was 33 her youngest child was born Two months before this event her mother, who had mild diabetes, died suddenly and unexpectedly of a heart attack at the age of 62 The patient somehow felt that in bringing her daughter into the world she had pushed her mother out However she did have the consolation of naming the child after her mother

At the age of 3 months the daughter developed pneumonia and almost died after a long illness Just at this time the patient s father died suddenly at 67 He had been ill with nephritis and hypertension but his death was not expected

At the time the youngest child was four she was exposed to a terrifying sexual assault Almost overnight she changed into a frightened little girl who continually clung to her father for protection, always preferring him to her mother For the next eight years she was taken weekly to a

sychiatrist She had to be accompanied by her mother or her father very time she went out of the house even to go to school

When the girl was 9 the psychiatrist conducted a test in which, when screen was placed between the little girl and her father she became xtremely upset but was not greatly disturbed when the screen was laced in front of her mother, leaving her father in view This experience nly added to the patient s bitterness and resentment She began having ttacks of precordial pain radiating to the left shoulder and arm re ated to either exertion or to emotional upset She did not visit the clinic however until at the age of 40 she began having menorrhagia Her at tacks of precordial pain persisted At that time the only abnormalities found on physical examination were a blood pressure of 152/96 and obesity (Height 149 cm weight 70 6 kg) A urinalysis showed a faint trace of albumin occasional red blood cells and 15-20 white cells on microscopic examination She did not return for two years, when she again sought relief for her persistent menorrhagia She developed bur sitis Her precordial pain again became prominent Her blood pressure now was 170/120 an electrocardiogram was normal and the urine con tinued to show albumin with red and white cells in the sediment Intra venous pyelogram showed a staghorn calculus in the right kidney A heminephrectomy was done in another hospital followed by a stormy convalescence and ultimate evisceration and abdominal hernia

Two months after the operation her blood pressure was 240/130 She noticed dyspnea on one flight of stairs and suffered anxiety attacks and severe headaches

In July of 1946 when she returned to the New York Hospital, her blood pressure was 194/112 X ray of the chest showed slight enlarge ment of the left ventricle The electrocardiogram remained normal, the intravenous pyelogram showed a normal left kidney Because of per sistence of the hypertension a right thoracolumbar sympathectomy was done in September 1946 and the remainder of the right kidney was removed

Postoperatively there was little change in her blood pressure She noted pain in her joints mostly the neck back shoulders and right hip and became a semi invalid tense anxious and fearful She allowed her husband and her daughters to do much of the housework and all the shopping The thought of going into a store to buy something made her panicky nauseated and dizzy with tachycardia and sweating

In May 1947 she was again admitted to the New York Hospital, this

time for a left thoracolumbar sympathectomy In the immediate post operative period she suffered marked orthostatic hypotension requiring an abdominal binder, as well as elastic bandages to the legs Her tendency to black out on standing added to the panic she had experienced before her operation She further limited her activity at home, participating in no social activity except for visits from friends Her husband accepted her limitations without protest The daughters were sympathetic, affording her some satisfaction by doing well in school

Over the next two years the blood pressure slowly rose and the orthostatic hypotension disappeared Precordial pain and dyspnea persisted Nitroglycerine had no effect on the precordial pain and only served to produce a pounding in the head Weight reduction was initiated by diet and she lost about 10 lbs Because of a BMR ranging around −22 and a blood cholesterol which averaged about 450 on repeated determinations, she was given thyroid up to 3 grains a day This had no effect on her weight, her BMR, her cholesterol or her symptoms In April 1948, at the age of 46 she first consulted our clinic Blood pressure at this time was 168/105

Throughout the next five years her synptoms varied little and her activity remained markedly restricted She developed several new complaints Varicose veins, which had developed over the years, became worse A left saphenous ligation had been done elsewhere in 1944, but varicosities had soon recurred In May 1950, at the age of 48, she was admitted to the hospital for a mild and chronic thrombophlebitis of both legs Anticoagulant therapy was not thought necessary and the process subsided with bed rest and hot wet packs In February 1951, she was admitted again for a bilateral phlebectomy which put an end to her difficulties from varicosities

In April of 1951, while attempting to do some shopping she had an episode of panic palpitation, nausea, sweating and precordial pain with severe left low back pain She was admitted again to the hospital where the symptoms subsided with bed rest and physiotherapy Physical examination and x ray studies showed nothing except evidence of osteoarthritis Urinalysis at this time was unremarkable

In September 1951, she made another attempt to go out and this time in addition to her usual symptoms, she developed right upper quadrant pain which led to admission to another hospital where the pain subsided after a few days This, however prompted an x ray study of her gall bladder which was found to be full of stones Accordingly, in October of 1951 a cholecystectomy was done

The patient was always very docile almost servile in her relationship to the hospital Always addressing the doctors as 'Sir,' she followed their recommendations without complaint unless a change in her way of life was involved When urged to be more active she would smile with the air of a martyr as if she were being asked to do something impossible and say she would try

Throughout the first four years of her treatment in the clinic she was seen at three to four week intervals Although most of these interviews were taken up by circumstantial accounts of her symptoms, she noted transient improvement for one or two days after each visit

Her dreams were predominantly concerned with three subjects 1) being out in the street naked or inadequately clothed 2) being away from home and unable to find her way back 3) beating her younger daughter for not doing something that would save the lives of both of them Occasional dreams were related to attempts to go back to work in a hospital Many dreams on all of these subjects contained a good deal of violence and she often awoke terrified and in a cold sweat

The dreams of violence were in marked contrast to her daily behavior She believed that loss of temper served no useful purpose and indeed, that it was a terrible thing to lose one s temper She believed that all differences of opinion could be resolved by free discussion and naively stated The person who is wrong will give in Her husband s view was stated as follows I always let my wife have her own way, it s easier that way Then we don t get excited There are ways of getting around things I say yes and frequently do what I want

As the children grew up they stopped talking to their mother about their own affairs and became moderately rebellious

The older daughter married at 21 a man whom the patient considered irresponsible and socially inferior The younger daughter went to college but was evidently unhappy and unwilling to share her problems with her mother

During this period (November 1952 to April 1953) the patient was seen once a week As reassurance was given and attempts were made to help her seek satisfaction other than vicariously through her daughter, her blood pressure achieved its lowest and essentially normal levels

As the interviews progressed it was not difficult to get her to see the fruitless pattern she had lived out in alternately appeasing then defying her father and in trying to compensate for her own frustrations in the lives of her children She began to realize that she had judged her kindly, responsible and devoted husband only in the terms of her father s stand

ards of schooling and had not derived the potential satisfactions that he offered After her first year at the clinic her resting blood pressure was reduced to the neighborhood of 140/88 A rise to 186/136 was induced during an interview in which her relationship with her daughters was discussed As she was able to express herself more freely to her physician, she gradually reduced her emotional dependence on her rejecting children She did not express any resentment directly to her children but became able to realize that her children were not her life Though she felt that her efforts at bringing up children were a failure, just as she considered everything else she had done a failure, she realized that she had a warm, affectionate and stable marriage Though she continued to have symptoms, she had fewer attacks of precordial pain Instead of occurring several times a day, they occurred only four or five times a week In February of 1952 she made her first visit in six years to a store, alone Though she had some palpitation and mild panic, she had resolved to make a purchase and she did She also found that she could travel around the city alone to meet people, which she had been unable to do before She found the courage to answer an advertisement in a newspaper for a part time job in a doctor's office She did not get the job, which was a relief to her, but at least she had made the effort

After each of these weekly interviews she felt better and this sense of well being lasted up to three days Her husband commented on how much better she was after each visit to the clinic

At the time of this writing she is far from a well woman Her blood pressure, however is at more normal levels, rarely higher than 140/90 and her neurasthenic reaction appears to be taking a change for the better

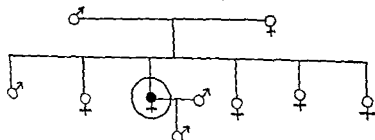
Summary This is a woman who developed a poor opinion of herself in childhood, partly by favoritism shown an older and prettier sister by her father She felt that she had failed her father because of her inability to attain the professional standing he desired She became a practical nurse in New York and married a man inferior to her in education and disapproved of by her family She attempted to assuage her sense of failure in her own life by living through her children This proved most unsatisfactory because of the congenital deformity of the older child and the psychiatric illness of the younger Care of these children put great demands on the patient so that she developed intense resentment toward them which she suppressed By the age of 39, one year after the onset of the psychiatric illness of her second daughter, the patient's blood pressure was 152/96, the beginning of a hypertensive illness

In addition to the hypertension this patient developed a neurasthenic reaction soon after her second daughter was well enough to get along without psychiatric treatment Her invalidism increased as she underwent varicose vein ligation, radium menopause, nephrectomy for staghorn calculus bilateral thoracolumbar sympathectomy and a cholecystectomy

Resentment against the children increased as they became more independent, making it impossible for the patient to live a satisfactory life through them Frustration, guilt and suppression of resentment occurred as she continued to try to establish a dependent relationship with them The blood pressure was only transiently affected by the sympathectomy Within a few months it was back in the neighborhood of 170/110 and continued at higher levels until she had been under treatment in the clinic for several months

With discussion the patient was able to realize that she did not need a dependent relationship with her children that she had a very good one with her dependable husband Resentment of her children, finally expressed freely to her physician though never to her children became of secondary importance since she was no longer as dependent on them With realization of this her blood pressure assumed normal levels With continued psychotherapy the neuresthenia, which was associated with the hypertensive reaction in this case appeared at the time of this writing to be lessening

CASE 19 *A young woman with severe hypertension in a restricted and frustrating life situation who died of a stroke within seven years of the discovery of her high blood pressure*



The patient was a tall slender woman who gave the impression of great suffering She was always attractively dressed and her hair was carefully groomed She was the third of six children of a Baptist father and a Roman Catholic mother Her father a conscientious hardworking

skilled laborer, spent his energies *in striving toward retirement* and a pension He was fair, but strict and unaffectionate His wife, the patient's mother, was a friendly but undependable person who frequented bars and sought the company of other men She often left the other children in the care of the patient, warning her not to tell her father

In later years the patient had an astonishing paucity of memory for her early childhood, even up to the age of 16 and 17 Her birth and early development were apparently normal although she was not sure whether or not she was a "blue baby" In any event, her physical activity was unimpaired and she was known in the neighborhood as a tomboy until the age of 7 or 8

At that time she had a severe illness lasting several weeks and involving intense pain in her legs She recalls that any movement was painful A heart murmur was discovered at this time Although this illness was not called rheumatic fever, she was treated as a cardiac invalid from that time on *Her most vivid childhood memory* is not of the frequent illnesses, but of the 'Don't, don't," from her father and mother when she attempted any physical activity Her older brother recalls vividly the change in her personality at this time, stating that she "retreated into a shell," whence she never returned From a child who climbed to the highest treetops, roller skated and ran around she changed into a child who sat on the stoop silently watching the other children play

She enjoyed school and did exceptionally well in her studies *However*, at the age of 14, despite the fact that she had no symptoms it was decided by the school health authorities that her heart did not permit her to continue in school She was intensely resentful and blamed her father for having allowed her to be taken out of school although she never was *able to tell her mother or father how she felt Outwardly she accepted the* limitations and was never able to feel free of them Even as an adult and despite the absence of symptoms of cardiac insufficiency she said, 'I still walk slowly I never hurry"

The impact of the cessation of her schooling except for the immediate *resentment*, was slow in developing Over the years, however, she became convinced that she was dumb" because of her lack of schooling The outward signs of this were an apparent inattention to her surroundings and a tendency to profess ignorance of all inquiries *addressed to her* This latter tendency was quite striking as well as humorous, to her friends, because she would frequently have a "double take" on things addressed to her An initial response of ignorance would bounce off her

shell and the second response would come a minute or two later, if her shell had been penetrated Much of her adult life was lived within this shell greatly limiting her participation in social activities

At about the same time she began school she also started Sunday school Neither parent went to church but because her father was the dominant member of the household she was started in the Baptist Sunday School She enjoyed the easy friendly atmosphere the Sunday school picnics and the sense of belonging to the group However when she was 11 the mother s family insisted that the children be brought up as Catholics This was another frustrating experience because she found the Catholic Church unpleasantly impersonal and austere There were no Sunday school picnics She recalled vividly one Sunday at age 12 before she was confirmed going to adult Mass by mistake, instead of children s Mass and being peremptorily ordered out by the priest She ran home to her mother vowing she d never go to church again On another occasion she was asked to sell a book of chances for the church She did not like the idea of selling the chances and when she returned the following week all her chances still in her book the priest became angry with her He told her not to return until she sold them all Again she ran home crying to her mother who eased the situation by buying all the chances herself

Despite these setbacks and though she longed for the freedom and fun of the Baptist Church she accepted the Catholic faith, making it, outwardly at least a part of her life I like my religion but I don t know too much about it Religion is something to be left at the door She later married a Catholic brought up her son as a Catholic and as an adult went to Mass every Sunday I don t feel right if I miss Mass " This was the most she could ever say about going to church She went to confession about every 4 or 5 months I don t know why I go—the life I lead—I never have anything to confess

It was not surprising that the patient s memories of her childhood were limited blocked as she was in physical intellectual and religious outlets She did recall however trying desperately but unsuccessfully to get attention and love from her father He would never allow her or any of the children to sit on his knee though the patient could picture him well into her adult life sitting in his easy chair with a very inviting lap

The patient did get some love and affection from her mother, but even this was less than she wanted or needed As much as she was able she tried to make sure that this was not cut off by shielding her mother in

her promiscuous activities When her mother went out of the house, leaving the children in the patient's care, she prepared dinner and set the table so that her mother might arrive safely five minutes before the father came home for dinner

Even before her menses began the patient emulated her mother's promiscuity by engaging in sexual intercourse with several boys in the neighborhood

After two years of this sexual promiscuity the patient was one day discovered in the act by the mother of one of her partners After many tears and entreaties she prevailed upon this irate woman not to tell her mother but was unable to dissuade her from telling her older sister

The patient could never remember much about her sister Indeed, except for this incident and her subsequent death, the sister did not exist in her childhood memories Again she used tears and entreaties as well as a promise to desist all sexual activity and her sister promised to tell no one about the incident

It was shortly after this that the sister became ill with meningitis and died The patient, now 12, rode to the funeral in a carriage and enjoyed the excitement of the horses running away with the carriage, but she never recalled the actual burial She does recall being well aware of the fact that her sister was the only one who knew about her sexual activity and that now she was dead

Despite these events, the patient continued to be sexually active for another year, and then abruptly stopped at the age of 13, for no reason that she could ever recall And she never admitted to masturbation as a replacement

At 14 the patient began menstruating, having been informed by her mother briefly The menses were established easily and regularly and were never associated with any pain or discomfort

When the patient was 17, her father forced her mother to leave the house because of her infidelity The patient with the other children pleaded with their father to allow their mother to come back He finally did after about two months Despite her mother's activities the patient could never find a bad word for her She did not want to face the fact that her only source of love was not perfect After her mother's death she often became angry with her father for making disparaging remarks about her mother but characteristically was unable to say a word to him about it

Though she never admitted to herself that her mother had imperfections, one of her actions at the age of 16 indicated at least that her

mother deserved to be hurt Both parents had been urging her to get a job Not wishing to work she resolved to run away She told her mother she was going to get a job and called an aunt to say she was coming to visit for a few days Two days later when her parents found out where she was she was sent home Her father was furious and her mother didn t say a word when she returned This was a bitter disappointment to her She had expected to be missed and to be warmly greeted on her return Thus another attempt at obtaining love and affection had failed

Following this episode the patient did find a job After several temporary jobs she went to work as a file clerk with a publisher at the age of 18 There she remained for 10 years until the magazine failed

It was also at 18 that the patient had her first love affair with a boy her own age When he kissed me I felt it down to my toes He is the only one who ever gave me a thrill with kissing After six months the boy went away for the summer and on his return told the patient that he had gotten another girl pregnant and was going to have to marry her

This was a terrible blow to the patient, from which she never really did recover Even 20 years later, long after she was married herself, her thoughts kept returning to this boy although she never saw him again, and whenever she passed his street she always looked down to see if she might see him

Despite this blow to her pride, she kept up her social life and by the following year accepted an engagement ring from a Jewish boy Although she ultimately broke the engagement she never returned the ring She began to associate with a young Irishman whom her mother hoped she would marry It was at this time when she was 21 that her mother died

Shortly thereafter her father brought in as a housekeeper a woman with whom he had been having illicit relations, and soon married her This step was so distasteful to the patient that she left his house and refused to speak to him for a year

On her deathbed the patient s mother had advised her to marry the Irishman an obese affable and patient fellow Two years later at the age of 23 she did marry him Although he proved to be a model husband, she never felt the same way about him as she had toward her lost love Even walking up the aisle of the church she wondered whether she was doing the right thing She had invited her father to her wedding but gained the impression that he disapproved of her choice though he never said anything Even in later years she never had occasion to change her original impression It may well be that a desire to rebel against her father as well as the desire to fulfill the deathbed wish of her

mother, was also a factor in her marrying this man If this was a factor in her marriage, it seems equally true that her inability to feel free of her father was a potent inhibiting force in her marital adjustment

The wedding night was a nightmare which set the pattern for her future sexual adjustment Sexual intercourse was attempted but proved to be extremely painful and was not actually accomplished until one week later For almost the rest of her life sexual intercourse was painful to her and "brought tears to my eyes" She would consent to intercourse about once in 4 to 6 weeks only after prolonged importunities from her husband

She began having dreams of sexual intercourse with a variety of men whose faces she could never see, but who never resembled her husband She enjoyed sexual relations in her dreams, experiencing full orgasm

The patient was eager to have children, and after one year of marriage she became pregnant During her pregnancy she felt "wonderful" Delivery was uneventful except for transient cyanosis which required the use of oxygen Because of this she was firmly cautioned against further pregnancies She had wanted a girl but accepted readily enough the son who was born The son, however, may not have felt so well accepted for, in the patient's words, "He never stopped crying for two years" At 5 he acquired hay fever and asthma

At 28 the patient lost her job and shortly thereafter her son began school This left her at home all day with very little to do Her husband was working at night and slept most of the day

In this setting headaches occurred They were unilateral, frontal and throbbing, frequently waking her from sleep, associated with nausea and vomiting and lasting 12 or more hours In addition to these, she also had bi-occipital, steady headaches associated with tightness of neck muscles She had attacks of "pleurisy" recurrent, and attacks of right upper quadrant pain termed "gall bladder attacks" At 37 her gall bladder was removed as well as her "appendix" but a pathological report indicated no evidence of disease She was first told that she had hypertension while in the hospital for this operation She had several attacks of "cystitis" associated with flank pain A few months after her cholecystectomy she was cystoscoped for one of these episodes but no abnormalities were found At this same time she developed a urethral caruncle which required cauterization This 10 year period was so full of illness that her husband who was frequently called away from his work at night to take care of some nocturnal illness of his wife gave up his job and went to work in a brewery during the day so that his wife would

not be left alone at night He never complained about his wife s illnesses, but remained kind helpful and considerate in spite of the fact that he did not like his new and less remunerative job

The knowledge that she had high blood pressure placed her in perpetual fear of death from a stroke 'as if a sword were hanging over my head She had trouble sleeping at night When she lay flat she felt as if she were going to smother and began to sleep propped up on three pillows She never had dyspnea on exertion could climb two flights of stairs without difficulty and never had ankle swelling or nocturnal dyspnea When excited or frightened her fear was increased by the rapid pounding of her heart To add to her troubles a benign breast tumor was removed when she was 38

Headaches became increasingly frequent until they were occurring almost daily She had withdrawn from the social group to which she belonged before her marriage and her only social life was an occasional visit to her sisters with whom she had little in common though she did bask in the maternal warmth of one of them the youngest about once a week The patient was 40 when she first came to the New York Hospital At that time her blood pressure was 215/130 The *fundi* showed lightly constricted arterioles and marked a v nicking *There were no* hemorrhages or exudates or papilledema The heart was slightly enlarged with normal rhythm and good heart ounds There was a harsh blowing systolic murmur heard all over the precordium loudest in the left 4th intercostal pace near the sternum The remainder of the physical examination was unremarkable No diastolic murmur was heard and there were no shocks or thrills Chest x ray showed fullness of the left ventricle Electrocardiogram and renal studies were normal as was the angiocardiogram but on cardiac catheterization it was found that the oxygen content of the outflow tract of the right ventricle was higher than that of the right auricle The pulmonary arterial pressure was high

It was the clinical impression that in addition to hypertension the patient had congenital heart disease with a small interventricular septal defect which could not be visualized on the angiocardiogram She also had vascular headaches of the migraine type and muscle tension headaches Sympathectomy was considered and decided against because of the congenital heart lesion

The patient was seen in our clinic approximately once a week for the period of the next three and one half years She accepted the idea of coming to the clinic in the same way she had accepted everything else in her life that is docilely Every visit required a one and one half hour

ride in the subway to the hospital and the same ride back home again She was usually apprehensive before each visit and frequently asked herself, "Why do I come?" Occasionally she suggested to her husband that she stop coming, but he found her so much easier to live with after these visits that he insisted she keep coming despite the cost The muscle tension headaches disappeared entirely and the migraine became much less frequent From three to four or more headaches a week she had one headache every two to three weeks and on one occasion went three months with only one headache

Her blood pressure showed very little significant change Despite her cooperative attitude the patient proved to be a very rigid person It was impossible for her to change her way of dealing with herself or with others Once after the possibility was discussed that she might have a lot of hostility buried inside her, and that it might be helpful for her to express it more freely, she reported back to the clinic that she had really expressed anger toward her husband For 15 to 20 minutes she had shouted abuse at him Afterwards she was exhausted as well as amazed and also frightened by the enormity of the feeling of hate which she had felt She literally had not known it was in her Unfortunately, this episode occurred on a day following a visit to the clinic, so that the immediate effect of this outburst on her blood pressure could not be ascertained Sixteen days later her blood pressure was not significantly different

On two or three other occasions the patient experienced this intense feeling of hate toward her husband but it only lasted for two or three minutes and she was completely unable to utter a word Instead, she lapsed into a profound silence until the feeling passed 'My husband is so good to me"

It is believed that this hostility was actually felt toward her father, rather than toward her husband It had been he who had stopped her physical activity at age 7, changed her religion at age 11, taken her out of school at age 14, thrown her beloved mother out of the house at age 17, and from whose house she herself had departed, when a rival mother was brought in Several times she dreamed that she was attempting to have intercourse with her husband while a third person, whom she identified as her father, was present and was indicating that she was doing wrong

About two years after she began coming to the clinic she developed an intractable cough, fever, night sweats, anemia and petechiae over the

lower extremities After being admitted to the hospital for study she developed typical congestive heart failure which responded to mercurials and digitalization She had two convulsive seizures and lapsed into a semicomatose state The laboratory data, including examination of the spinal fluid and numerous blood cultures were unrevealing but it was nevertheless decided to treat her on the basis of a presumptive diagnosis of subacute bacterial endocarditis She was in the hospital for four months and then resumed her visits to the clinic As before, therapy was directed toward encouraging her to transfer her needs for dependency from her father to her husband and also to express her hostility toward both in an appropriate and direct fashion

Her sexual dreams continued as they had before her illness and her sexual desire seemed more intense than it had previously been Her relationship to her father became a little clearer 'I feel like a frightened child with him She had a dream of being very content living in a beautiful house alone with her father Then, in her dream, she returned one day to find the house all changed around with three girls living in it These girls were the daughters of a woman whom the father was considering making his third wife They told the patient she could stay in the house if she didn t touch anything

One day her father suggested that she stop running to the hospital because nothing was being done for her This provoked a reaction of rage in the patient which amazed her with its intensity but unable to express her feeling at all she merely lapsed into silence For a week afterward she became furious every time she thought of her father or saw him but she could never get herself to express her feelings directly

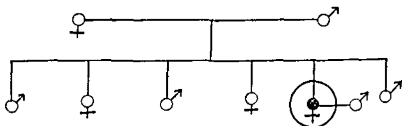
After this the patient had occasional dreams about her mother, dreams in which her mother was not the warm loving person she had always idolized In one of these when she met her in the street, her mother passed by without greeting her The patient ran up to her put her arms around her and pleaded for forgiveness In discussing the dream she said I don t know why I should ask forgiveness of my mother I never did anything to her I was always helping he and doing things for her

Blood pressure remained elevated in the neighborhood of 200/115 until 14 months after her discharge from the hospital and 45 months after her first visit to the clinic he had an intracerebral and intraventricular hemorrhage She was admitted again to the hospital but died in 24 hours A post mortem examination confirmed the presence of an inter

ventricular septal defect in a grossly enlarged heart (500 gm) There was no evidence of healed endocarditis, the valves were all normal, and the nature of her long febrile illness remains obscure

Summary The patient was a 40 year old woman with known hyper tension for three years As a child she had felt rejected by a cold father, and had been restricted in many of the normal outlets of childhood She was unnecessarily restricted in her physical activity because of her con genital heart lesion, and for the same reason was taken out of school at an early age As she grew older, the hostility which she occasionally showed as a child became covered up and buried, even to the point where she was unaware of it herself Most of this hostility was directed at her father, with occasional spells of hostility directed to other members of the family In four years of psychotherapy the patient learned of the existence of this store of resentment against her father, became amazed and frightened when she actually felt it, but never was able to express it directly to her father It is a matter of speculation as to what the course of her blood pressure would have been had she been able to do so Reasoning from analogy with other patients it seems likely her blood pressure would have been lowered Death at the age of 44 years from an intracerebral hemorrhage precluded answering this question definitely

CASE 20 *An insecure but vigorous and resourceful woman whose life ad justment decompensated with the appearance of hypertension in a setting of frustration over her husband s inadequacies and guilt over her hostile attitude toward him*



The patient was a very soft spoken, self effacing and diffident woman She sat back in the corner of a chair as if not wishing to take up much room She was born in 1900 in a small town near Vienna the fifth of six children of Jewish parents Her father was a quiet patient, unaggres sive man who could not withstand his wife s demands Although next to the youngest, the patient earned from her domineering mother the approving designation of "her most useful child ' She hated disturbances

of any kind and did her utmost to smooth out the differences between her parents She said I never had temper tantrums If angry I stopped eating and talking ' Her mother died of valvular heart disease at the age of 40 when the patient was 8 She had been a shy child who had difficulty making friends After her mother s death, she felt too ashamed to go back to school I was afraid of being pointed out as the girl whose mother had died Perhaps because she had learned to make herself so useful around the house in addition to her shame at returning to school she was allowed to stay home Her father soon married a woman 20 years younger than himself This woman was rather irresponsible and had no desire to care for her husband s children She wanted to live ' The step-mother was only too happy to allow the patient to assume the burden of household duties which she did until she left home some years later

Though she had not wanted to return to school she later bitterly regretted the fact that she was not encouraged to resume her education From this time on she was very unhappy As the years passed two half brothers and two half sisters were born and their care was relegated to her She was never able to go anywhere without taking the current baby with her I couldn t go places my friends did I got used to it It couldn t be different

She had a terrifying dream when she was 11 one in which her grand mother was going to do something terrible to her step mother and I didn t want her to do it

One by one she watched her older brothers and sisters leave this unhappy household She remained sympathetic to her father who was however unable to give her much in the way of sympathy or affection because of his rather demanding second wife In addition her step-grandmother had become a member of the household During the First World War poverty hit the house and she could not stand to hear her step grandmother heap abuse upon her father for his financial inadequacies

The patient s pattern of wanting to be depended upon became a deeply ingrained habit even though she resented her own behavior This is my nature—to take things on And then I get used to it and I can t turn back The patient continued to keep house for her father until the age of 17 when she could stand the household no longer She borrowed money and bought a railroad ticket to Berlin planning to stay with her sister two years older who had already established herself there She did not dare tell her step mother or father where she was going until

her step mother asked her on the morning of her departure Then, terrified, she confessed what she was doing Her step mother did not even offer to give her some food to take on the train with her

In Berlin she got a job as a seamstress for a tailor "I didn't eat much, I sent most of my money home," hoping it would make life for her father a bit easier Despite this, she enjoyed life in Berlin "It was much too good for me I wasn't used to it I could eat and go and do what I wanted" Though she sent most of her money home she did not cease to take on responsibility When her older sister got married she made her wedding dress and bought the railroad tickets for the honeymoon out of her own pocket

Three years later, when she was 20, she made a trip home to see her father The war was over The visit which was planned for two to three weeks lengthened to nine months because of political unrest in Germany Very soon she found herself in the old intolerable groove of running the house for her step mother She was only too glad to get away again when conditions permitted

All her life her health had been excellent She had had measles and scarlet fever as a young child, and possibly she had a mild case of small pox at 18, at the close of the First World War She believes that she began menstruating at the age of 15, although she had no bleeding at this time She had developed normally sexually but with the onset of what appeared to be menstrual pain every month she had no bleeding Of this she said not a word to her father or step mother but in Berlin she went to a doctor An imperforate hymen was found and operated on Thereafter her periods established themselves in a 28 day cycle with moderately severe pain

When living in her father's house she had been forbidden the company of boys When she came to Berlin she met boys and had an opportunity to go out with them, but refused to do so "It was wrong to go out with boys"

When she was 21 she met her future husband He was a religious teacher, a student of the Talmud This occupation suited him because he was completely lacking in aggressiveness and could not stand up for himself She liked other boys better but his religious background fitted better with the strictly religious background to which she had been accustomed in her father's home Though she only saw him four or five times a year for the first three or four years she finally married him when she was 26 years old "I knew he would not make much of himself in life

because of his lack of aggressiveness They told me I was a different type and would make up for it '

By this time she had established herself in her own dressmaking business She supported herself, her husband and continued to send money home to her father She tried to get her husband to help out in her business but ' I was always glad when he did not do something wrong " "I wanted my husband to be like others to be successful but he couldn t do that ' I wasn t happy because I wasn't satisfied " He was indifferent to his lack of success and although she was acutely sensitive to his failures she was able to compensate fairly well by her own success

She had always wanted children of her own but knew very little of sexual matters before her marriage and had no sexual contact before marriage Intercourse after marriage was extremely painful and almost impossible This led her again to the doctor who advised an operation for a congenital atresia of the vagina This was done shortly after her marriage Thereafter intercourse was possible and indeed became a source of pleasure to her She was never sure whether she had an orgasm or not but she felt relaxed after intercourse and fell asleep promptly The next day she would feel more lively Intercourse never occurred more often than once in two weeks It was such a strain on him it seemed to make him sick to have intercourse '

She was bitterly disappointed at her inability to become pregnant and then at the age of 32 she developed a left pyosalpinx which required removal This left her with a postoperative abdominal hernia She was however able to continue in her dressmaking business Though her husband was unable to contribute in any way to the success of the business, the small amount of prestige he received as a religious teacher contributed in a small way to her satisfaction in life

The advent of Hitler forced them to flee She made all the arrangements and finally after a forced detour to Cuba arrived in the United States Here she obtained employment in a factory sewing labels on clothes She continued to support her husband though she began to resent his incompetence and lack of aggressiveness more and more

Then he learned that all her family—father step-mother brothers and sisters—had been killed by the Nazis This was an overwhelming blow to her and one she could never talk about without tears Having always obtained some satisfaction in life by doing things for others particularly for her family, she now had no one but her husband to do things for His lack of aggressiveness became more intolerable She began

to have a variety of symptoms She had always had colds, but her nasal congestion became worse and she developed an acute middle ear infection requiring a myringotomy in 1940 Because the colds and sore throats persisted she had a tonsillectomy in 1943 without benefit

Then a hysterectomy was done because of uterine fibroids For the first time she was told that she had hypertension After the operation her illness began She developed menopausal symptoms with severe hot flashes, she began having severe pains in her back, knees, hips and neck she developed headaches, pain over the left precordium worse with exertion, associated with some shortness of breath Although she was able *to return to work after the operation, for a few months, she was soon* told by the doctors that her high blood pressure made it dangerous for her to work She therefore stopped work at the age of 43 Soon she developed episodes of severe burning epigastric pain, radiating through to the back, occasionally associated with nausea and vomiting

Her husband found a job in a factory He became increasingly troubled with pains in his hands, however, and after two years was forced to quit this kind of work He was told that he had arthritis He then obtained employment as caretaker for a synagogue, which represented a terrific comedown for her She could barely bring herself to tell anyone what her husband did Helpless to do anything herself because of all her aches and pains, and coupled with the fear of the consequences of hypertension, she redoubled her efforts to force her husband to make something of himself Every effort was doomed to failure Her only occupation was to attempt to keep house and to prepare food for her husband When she put pressure on him to do something, he reacted by not eating This intensified her sense of her own failure This sense of frustration, together with enormous resentment against him, was the usual factor precipitating her attacks of epigastric pain

She became a semi invalid spending half her time in bed Any activity about the house exacerbated her pains which, in turn, kept her in bed for two and three days at a stretch Doctors whom she called in for help all told her her blood pressure was high and that she should rest This merely increased her fears about her own health and served to convince her she was suffering from severe organic disease

Finally, when she was 47, she was referred to the New York Hospital for consideration for sympathectomy Her blood pressure was found on initial examination to be 190/130 but fluctuated widely from visit to visit The fundi showed moderate arterial narrowing and a v nicking

but the remainder of the examination was normal The chest x ray, EKG and renal studies were also normal

The patient was only moderately faithful in coming to the clinic On many occasions she missed appointments because she was 'too sick' The same topic came up repeatedly in interviews My husband is a very fine person but he is difficult He doesn t want to aggravate me I m so very irritable I try to hold it back but just can t Then after such an excitement I m sick for three or four days I would like if possible to go away some place for a time

One day her husband answered the phone wrong She exploded and called him an idiot I wanted to hit him to hurt him I couldn t tell him how I felt I couldn t sleep all night It went to my stomach my hands my knees It went from one joint to another I lived all my years over yesterday I know he can t help it I feel guilty Her blood pressure at this time was at a new low of 148/94 Two weeks later it fell to 138/88 Expression of her feelings made her feel terribly guilty however so she made excuses for her husband and one month later her BP was back up to 190/125

On several occasions temporary separations from her husband were arranged for her in convalescent homes These were never of significant benefit because she felt guilty at leaving her husband He is so helpless who will take care of him?

The more she expressed her resentment toward her husband the lower her blood pressure was found to be Though she hated to do so she became able to predict whether her blood pressure would be high or low by whether she had expressed herself in the preceding few days Her intense guilt over these expressions however prevented her from continuing them and her attendance at clinic fell off

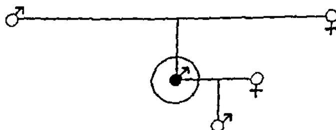
At this writing she remains essentially as she was when she first came to the clinic five years ago She is still very dependent on her husband whom she resents enormously for his inadequacies The idea of leaving him makes her feel guilty expressing resentment to him makes her feel guilty She is caught in a trap from which she has as yet been unable to escape

Summary The patient is a 53 year-old woman with hypertension known for 11 years The fifth of six children she was known as the 'best child meek and obedient The death of an aggressive yet dependable mother when the patient was 8 left her to take over the household duties for a weak father and an unsympathetic step-mother Angry at her

father for not encouraging her return to school after the death of her mother, and angry at her step mother for making her do all the house work, *she finally rebelled and left* home at the age of 17 She established herself in Berlin as a dressmaker, yet continued a dependent relationship to her father by sending most of her money home At 26, she married a religious man, even less aggressive than her father Although resentful of his incompetence and lack of success, she made up for it by her own success At 37, with the rise of the Nazis in Germany, her business was taken away and she arranged escape for herself and her husband to Cuba at the age of 38, and finally to the United States when she was 39 *In each place she earned the money and supported* her husband At 40, she learned that all her family in Europe had been killed by the Nazis, leaving her with only her meek incompetent husband At 42, a hysterectomy was performed, hypertension was discovered and she was advised to stop work She thus became completely dependent upon her husband, whose incompetence and lack of aggressiveness aroused enormous resentment This, in turn, made her feel guilty and caused her to attempt to suppress her resentment

During five years of psychotherapy it was possible on several occasions for her to express her resentment to her husband and when she did this her blood pressure would drop to normal or near normal levels It was *not possible, however, to break her dependent relationship* to her husband Expression of resentment caused her so much guilt and anxiety, particularly as her husband was unable to tolerate expressions of hostility, that she felt unable to continue expressing herself and her hypertension was never permanently altered

CASE 21 *A tense repressed young man whose high blood pressure (180/110) fell to normal during two years of observation in the clinic in association with the gaining of confidence and a newly found capacity for self assertion*



The patient was a slender young man with wavy light brown hair and a tense but ingratiating and slightly effeminate manner He was born in

1923, the only child of American born Protestant parents a cautious, rigid and over protective couple who did not allow him to participate in the activities of the other healthy active boys His father s parents had deserted him at an early age and he was brought up in an orphan asylum Working for many years as a milk man, he suffered from a duodenal ulcer but he never allowed this to interfere with his work He had no friends and no social life On Saturday night he would go out to have a few drinks or more coming home in a gay mood The family had a small apartment with two bedrooms At first the patient slept with his mother One of his early memories was of his father coming home ' tight,' of his being taken out of bed and put in the living room and of his father and mother fooling around ' having sexual intercourse The patient thought it terrible that his mother giggled and obviously enjoyed the whole procedure

The mother was considered by the patient to be the dominant member of the household perhaps because she did most of the talking However, when the father laid down the law in a quiet way no one even considered disobeying or asking him to change his mind Occasionally the mother tried to help the son escape punishment after he had broken one of his father s rules but the rules themselves were never questioned She was affectionate and over protective governing every detail of his life

He had very little memory of his early childhood except that he clearly recalled his father s punitive attitudes When he was 5 years old he and his father began to share a double bed and it was not until he was 11 years old that twin beds were acquired

By the time he was 14 he was very conscious of being restricted in almost all his activities His severest restriction was bedtime The father went to bed at 6 00 or 7 00 in the evening in order to start on his milk route at 1 00 A M and his son had to be in bed at 9 00 P M promptly having to crawl into bed to avoid waking his father On occasion, when he was late he was terrified and would cower in bed waiting for a blow from his father which however never did actually arrive

He did well enough in school and made friends easily He was intensely competitive and enjoyed athletics It was a cruel blow to him when his father forbade him to play football on the grounds that he might get hurt His father also disapproved of his running around with the boys in the neighborhood All these restrictions were based on the premise that he might get hurt and be incapacitated for future work

The son early gave up rebelling openly to his father but did so behind his back when he felt he could get away with it This however entailed considerable guilt which was not assuaged by the fact that his mother

frequently aware of his transgressions, usually overlooked them Thus at 17, he bought an old car without his father's knowledge, and went to the beach with the boys He played football at times, but his conscience always troubled him He resented his father enormously During this period he found that he was quick to get angry inside—at real or fancied slights—but he did not show it His mother had always disapproved of any show of anger on his part If he showed any tendency to get into fights or to lose his temper, she threatened him by saying it would harm her health if he were a bad boy Indeed, he developed a fear of being hurt even though physically he was well built and strong He was proud of his body and, coupled with his fear of being hurt, was a fear of being disfigured Both these factors kept him out of fights

He became aware of sex at an early age and was disgusted and horrified at the way his mother gave in to his father At the same time, his mother told him that everything sexual was bad In his early 'teens he was strongly attracted by girls in school and did an average amount of necking and kissing By the age of 17 he was going with a girl with whom he had regular sexual relations for one and one half years Though he continued the activity it made him feel "dirty" each act was accompanied by intense guilt I felt my mother sitting over me and I did not enjoy it "

He finished high school at 18, in 1941, and obtained a job Despite his adult status as a wage earner his parents' attitude toward him did not change With the beginning of the war six months later he gave up his job and joined the Coast Guard at the age of 19 He was glad to get away from home and his mother was not able to protest effectively This also allowed him to break up the affair with the girl with whom he had been having sexual relations

While in the Coast Guard, his pulse was found to be 120 It remained at that level on repeated checks during the next 10 days On completing Radio school where he did well, he was told that both his pulse and his blood pressure were high and these remained high on every check through the remainder of his service career At this time he began having pain in the back of his neck and difficulty sleeping These troubles too persisted

The remainder of his Coast Guard career was uneventful He had one love affair with a girl in Florida whom he planned to marry A year s separation and the certain knowledge that his mother would object served to terminate the affair with little regret on his part

On his discharge he was offered the opportunity to go to a hospital for study of his hypertension He refused I figured when I crawled

back into my hole at home things would be all right, but they weren't' His mother and father continued to treat him as a little boy He was still required to be in bed by 10 o'clock every night, to stay home every Monday night in order to talk to his mother, etc He was expected to find a job similar to that of his father Unhappy in in this situation he was determined to better himself and not to repeat the pattern of his father s life He wanted to go to college on the G I bill but his father and mother told him that college would do him no good and that he wouldn t be able to pass the course What did he think he was anyway, trying to set him elf up as something he wasn t?

Initially he obtained a job in a bank, as a partial rebellion against his parents wishes, but persisted in developing plans for going to college Within ix months he was having severe daily band like head aches His family physician found his blood pressure to be 208/130 Because the headaches kept recurring and because the blood pressure remained high (with variations as low as 150/80) he was referred to the New York Hospital in December 1946 On his initial visit his blood pressure varied from 180/100 to 146/80 The remainder of the physical examination was entirely normal

Laboratory work including blood counts, urinalysis renal function tests Mazzini and a chest x ray were normal

He had difficulty accepting his visits to the clinic because he hated the thought that something was wrong with him He was ashamed as well as afraid of his hypertension He felt insecure in crowds and panicky in subway stations or in high buildings for fear he would throw himself in front of trains or jump from high windows He had a feeling of un steadiness which was worse when he had to meet people particularly superiors at work One night he dreamed of being in bed with a married woman whose face was blank He wondered why she was not in the other twin bed Then in his dream he realized that her husband was absent so with relief he undertook to have intercourse with her

During the first year and a half he was quite regular in his attendance at the clinic except for one lapse of three months He never became aware of any incestuous desires toward his mother but he came to realize how dependent he was on her and also how much he resented her efforts to control him and to make his decisions for him Ultimately he did learn to speak up to his mother and to take more control of his own affairs Whereas formerly he had given her his money and she had bought his clothes he now handled his own finances and made his own purchases He never was able to express anger toward his mother but at times he did show marked hostility to his physician It was felt that this was re

lated to feelings of guilt because his mother disapproved of his coming to the clinic

His feelings toward his father were mixed His hostility to him was mixed with admiration He admired his father's strong will, his never missing a day's work despite his ulcer pains, his dependability He resented his father's inflexibility, lack of affection and sympathy and he resented the guilt his own resentment entailed As the years passed he found that although he became furious with his father and often felt like hitting him, he never was able to express his feeling directly

Shortly after his discharge from the service he met and fell in love with a girl two years his junior The possibility of marriage presented three problems 1) She was Catholic His mother was violently anti Catholic and had never become reconciled to the fact that four of her own sisters had married Catholics 2) He was a college student with a part time job and did not feel able to support a wife 3) He was fearful that his blood pressure would prevent his getting a good job

When he did tell his mother about his intentions of marrying a Catholic girl, *"She was dead set against it" He began taking instructions in* the Catholic faith and was married in the Catholic Church after his conversion Neither he nor his mother dared to tell his father, of his change in religion

The marriage worked out well He had told his wife beforehand of all his previous sexual activities so that he would not be troubled by a guilty conscience at a later date He did not, however, tell her of all his symptoms, though he told her of his visits to the clinic for hypertension After his marriage he again stayed away from the clinic for 13 months, during which time he continued to go to college and his wife continued to work He returned to the clinic because of the same old symptoms and continued concern about his blood pressure, which was 160/100 'I can t concentrate I get dizzy I have pressure on top of my head I feel anxiety over I don't know what I don't seem to be getting better I'm getting worse " As to the origin of his symptoms he was able to say, over protection on the part of my mother Lack of confidence in myself I always restrain myself in expressing anger to my mother I did a lot of rationalizing in making myself conform to my mother You can't be at odds with a person all the time "

He was living in a furnished room with his wife Just as in earlier years his father had insisted that he stay home every Monday night now he himself, felt impelled to visit his parents every Monday night He never

exchanged more than a few words with his father and, after dinner, he left immediately to drink beer with 'the boys' leaving his wife to talk to his mother Weekly visits were also paid to his in laws, which he enjoyed more They are the more social type"

In August 1950 he graduated from college with a B A degree Though he was able to work full time for his insurance company, no permanent job was offered him With encouragement from the clinic he forced himself to look for other employment 'I m afraid if I go look for a job I ll feel that insecure feeling during the interview I want to avoid that insecure feeling Shortly after this he was turned down for a job on the basis of hypertension The job had not been very attractive to him but he wanted to experience having a physical examination I could feel the excitement well up inside me I knew my blood pressure would be high

He then got a job which did not require a physical examination It involved selling I m progressing in the outside world but inwardly I m not doing too well ' He had now been married close to two years He and his wife both wanted children but economically he had not thought it feasible With considerable guilt they used contraceptives He also found himself getting extremely tense in church, particularly if it was crowded Gradually he came to realize he did not believe in all the tenets of the Church and that he had been afraid to admit it to himself He was also afraid of telling his wife about this for fear of upsetting her One year later with encouragement from the clinic he finally told his wife of his feelings on religion Thereafter he was no longer tense in church In a way he had rebelled against the strict discipline of his mother and father by becoming a Catholic The strict discipline of the Catholic faith was also more than he could tolerate and he therefore rebelled against this too Rebellion against the Church however, also involved his asserting his independence of his wife He was surprised at how easy this was and felt lucky that his wife accepted his statements without being upset

In September 1951, he returned to the clinic for further care after a year s absence His symptoms were unchanged He was frequently aware of becoming extremely angry—at his father, at his boss or at his wife but he still had not lost his temper I feel the need to blow but my anger turns to kidding so fast

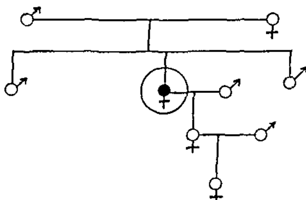
He then changed to a job with better pay and better prospects He was pleased when he passed a physical examination and was told his

blood pressure was 140/88 He now felt able to support his wife and a family without her salary and *for the first time they decided to have a baby* His wife became pregnant and delivered a healthy baby in July, 1952

During the early part of his attendance at clinic his blood pressure ranged in the neighborhood of 180/110 As he gradually emancipated himself from his mother, however, and became freer in his relations with his wife, his blood pressure fell to 120/80 It was never recorded again *higher than 152/88 and the last reading was 145/80*

Summary This 30 year old man was brought up by rigid overprotective Protestant parents Athletic activity was forbidden Sex was considered bad Anger was frowned upon Ambition was ridiculed Entry into the Coast Guard during the war meant escape from parental authority, but substituted other restrictions Hypertension and tachycardia, along with other symptoms, developed A return to parental authority produced unexpressed resentment and a desire to rebel Persistent hypertension and symptoms of insecurity lead him to seek medical help During six years of intermittent attendance at the clinic this patient rebelled against his family by graduating from college, and by marrying a *Catholic girl though never actually expressing resentment* to them Though at first he substituted dependence on his wife for dependence on his family, he learned to become more independent, and to express his feelings of anger to his wife, which she tolerated well With this change in himself his blood pressure fell to normal and has remained so for three years

CASE 22 *Moderately severe hypertension in a middle aged woman who attempted to live out her own frustrated aspirations through the life of a rejecting daughter*



The patient was a calm and placid appearing Negress perhaps a little sad and sullen but possessed of unusual poise Her voice was soft and slightly monotonous Despite the fact that she was born in a segregated community in South Carolina she stated that she was unaware of any discrimination until she came to New York after her marriage She had one older and one younger brother

Her father was a carpenter, well respected in his community and a good provider Although strict and of a rather fiery temperament as a young man when his children were small he mellowed with age As a child the patient thought him cruel Not till I was married did I appreciate his good qualities

She was nevertheless her father's favorite while the mother a sullen, discontented person favored the boys and seemed to resent the close father-daughter relationship It was always difficult for the patient to describe her mother She was elaborately impartial ' punishing all three for the misdeed on any one of them She rarely quarrelled with her husband but blamed him for her unhappiness When the children were old enough to care for themselves she left him moved to New York and remarried

As a child the patient did not consider herself unhappy She was docile and liked to please She accepted the point of view that Whatever your parents do is right Quarrelling or disagreeing with one's parents was considered high treason She never got along very well with her older brother but for the sake of maintaining a close family unit all quarrels were kept hidden from her parents Although she did not recollect the birth of her younger brother she always maintained close ties with him

The patient enjoyed school and did well despite the fact that she was almost always late because of having to do household chores for her mother She had hoped to complete high school and perhaps go to college But at the age of 16 when her mother had left the home her father insisted that she stay home to look after the house The patient resented this greatly and hated the housework but never expressed her resentment I never did explode I trained myself No matter how aggravated I am I always appear calm

Her social life during this period was practically nonexistent She never went out with boys alone When she finished school she spent her time doing housework or reading Religion occupied an important part of her life She was brought up both Methodist and Episcopalian in that she went to both Sunday schools every Sunday She also went to an Episcopal school during the week As an adult she considered herself

Episcopalian She found religion a comfort to her and derived a feeling of uplift when she went to church, which she did about three fourths of the time She began reading the Bible and her prayer book as a child and kept this up as a daily procedure

When she was 19, a widower of 40 asked her to marry him She accepted, in order to get away from home Her husband, a barber, brought her to live in New York City, where a daughter was born one year later When the daughter was a baby an episode occurred which impressed and greatly frightened the patient Her husband took the child for a walk without telling the patient where he was going "I got so angry, if I had had a knife I would have murdered him" She was mainly frightened by the intensity of her own hostility

Ten years later the husband died suddenly of a stroke, and the patient devoted herself completely to her daughter who, she hoped, would fulfill the aspirations she had had for herself—higher education, professional attainments and personal perfection (always neat, always on time) She surrounded the girl with the same strict atmosphere which she had known as a child She wanted her daughter to be her companion and confidante

At first the daughter tried to be close to her mother She pleased her by doing well in school and by doing well at singing, which the mother considered 'a highly cultured attainment" However, she did not share her mother's ambitions and soon took to lying about her activities and ideas in order to keep peace in the home Hereupon the patient embarked upon a long series of illnesses, including pulmonary tuberculosis, adenitis, salpingitis, iritis and syphilis The latter illness shocked her and she always denied any possible source of her syphilis, other than the man she worked for, a careless, unkempt bachelor who was sick with some sort of rash He employed her as a domestic

When she was 35 her blood pressure was 135/88 and, although normal, it was considerably above all previous blood pressures which were in the neighborhood of 110/70

Two years later her blood pressure was 140/100 The daughter was now openly sullen The patient felt hurt and intensely resentful Occasionally she expressed her anger but this upset both of them It made her feel guilty because she wanted desperately to maintain a close relationship with the girl, who continued to do well in school and in her singing

The daughter entered college at 17 but a year later became pregnant and, although a marriage was hastily arranged, schooling was aban

doned and the patient's dreams for her daughter were shattered Epigastric fullness and eructation developed, which finally led the patient to consult a physician At this time, when she was 40 years old her blood pressure was found to be 182/140 For the next five years her private physician continued to record it at about this level

Within a few months of marriage, the daughter's husband went off to war never to be seen again, and so she returned to live with her mother Her attitude now was not only sullen but argumentative as well The patient did not complain of the girl's hostility but began to have daily headaches and frequent episodes of lightheadedness

The patient was 46 when first seen in the clinic and her blood pressure was recorded at 200/118 The fundi showed narrowed arterioles with an increased light reflex and moderate arterio-venous nicking There were no hemorrhages or exudate The heart was felt to be slightly enlarged and there was a soft apical systolic murmur The lungs revealed slightly diminished resonance, fremitus and breath sounds at the left base in the axillary region but were otherwise clear There was a well healed lower left rectus abdominal scar The liver edge was palpable 3 cm below the right costal margin but did not feel abnormal The remainder of the examination was unremarkable

She attended the clinic once a week for an hour's interview for a period of several months and then came at less frequent intervals thereafter She was always cooperative pleasant and composed After a few weeks of psychotherapy plus phenobarbital 032 gm three times a day all symptoms disappeared She felt vastly improved Her blood pressure however did not change markedly except that she had occasional diastolic readings below 100 When the subject of her daughter was first brought up as part of the routine investigation of her background her face became stiff she averted her eyes and said Do we have to go into that? I don't choose to discuss it " With persuasion however, she discussed her daughter fairly freely Details of this mother daughter relationship were confirmed by subsequent interviews with the daughter a very pleasant girl who found life with her mother quite difficult

Treatment was directed toward encouraging her to express her feelings more freely and toward helping her develop interests and satisfactions independent of her daughter At first she found it extremely difficult to express anger at all but within four months for the first time she spanked her granddaughter I felt satisfied relaxed I used to feel miserable when I punished her with a tight feeling in my chest The next day her blood pressure was at its lowest recorded level—178/95 On another

occasion, after a relatively free expression of hostility toward her daughter, her blood pressure was at a fairly low figure, 190/90

Along with this progress toward expressing herself she also made some progress toward making herself more independent She became able to ignore many of the daughter's actions and to do what she pleased without feeling dependent She came to feel pleased when her daughter did something nice, rather than just resentful when she did something distasteful It was apparent, however, that she continued to build up resentment which was only partially relieved from time to time by an outburst of anger

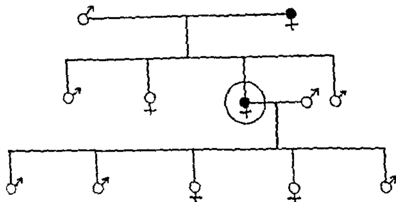
After a lapse of two months in her visits to the clinic, she told of an episode that had happened seven weeks previously She was sitting in the apartment watching her daughter flit about doing odd jobs "I suddenly had a terrific feeling of hate that practically tore me apart It was the worst feeling I ever had I thought that feeling had left me entirely For years I've carried her in my mind constantly The thinking (of her) was more like an unpleasant gnawing inside of me"

Nevertheless, the over all relationship with her daughter continued to be improved, although it was evident that the patient was still suppressing a great deal Her blood pressure for the next year remained in the neighborhood of 180/100

Summary With a strict father and an unsympathetic mother, the patient, a dependent person, early learned that a calm, pleasing exterior made life easier Frustrated by her father in a desire for continued education and mainly to get away from home, she married at 19 a man twice her age Her husband satisfied her needs and gave her a freedom of expression which her father had never done When her husband s sudden death left her alone with a 10 year old daughter, she tried to live through her daughter and make her daughter fulfill her emotional needs Initially co operative, the girl finally rejected her dominance Thus the patient built up enormous resentment which she suppressed in order to keep her dependent relationship In this setting she developed hypertension and a great many unrelated symptoms With psychotherapy and mild sedation her symptoms were quickly relieved She came to have a partial understanding of the importance of the mother daughter relationship in her illness She was successful in expressing some of her resentment and partially successful in becoming more independent As the frequency of visits decreased the old pattern of suppression of resentment tended to reassert itself There was no major change but

periods of lower pressure did correspond with periods of relatively free emotional expression and self assertion

CASE 23 *A 40 year-old woman who was afraid to express herself to her husband was discovered to have hypertension during an unwanted pregnancy She had brief remissions with lowering of blood pressure to normal when, with cooperation of her husband, she became more freely expressive*



The patient was a thin wiry woman sitting tensely on the edge of her chair who jumped up quickly when the doctor called her She was one of four children of a Roman Catholic mother and a Protestant father born in the United States Brought up as a Roman Catholic she had pleasant memories of her childhood Her parents were very permissive and gave her little direction She became her father s favorite but was a little afraid of him because of his easily mobilized and readily expressed anger Her mother was a quiet compliant woman who ultimately developed hypertension

Although she was encouraged to continue her schooling she stopped before she was 16 and drifted from one job to another At 18½ after one month s courtship with premarital sexual relations she married in a civil ceremony a forceful and domineering man who like her father was a Protestant Some time later he agreed to a religious Roman Catholic ceremony

Within a few years three children were born The patient s husband took little interest in them his wife or his home He often spent his evenings out drinking beer and coming home after 11 00 P M sometimes to

beat his wife brutally He seemed mainly concerned over finances He demanded that his wife account for every penny he gave her, although he did not object to her "borrowing" money from her parents or spending their son's Army allotment in her efforts to keep the home going

After 11 years of marriage the patient became pregnant for the fourth time, a most unwelcome event She became depressed and lost weight Her mother and father became so concerned about her that they moved in to stay with her for two and one half months However, she aborted, possibly as a result of taking quinine

Following the abortion she continued to feel nervous and tense Her appetite was poor, she lost weight and frequently noted a "lump" in the pit of her stomach She had difficulty falling asleep

Thirteen years after her marriage, at the age of 31, the patient felt the need of outside help and came to the New York Hospital At that time however, she mentioned none of her personal difficulties, and indeed no questions were asked about her personal life Her blood pressure at that time was normal Two years later, complaining of cough, hoarseness and a goiter which had been present since childhood, she again came to the hospital Examination was unremarkable except for the goiter, a blood pressure of 154/94 and a chronic cervicitis which was treated by electro cautery

For almost one year she visited various clinics of the hospital and then became pregnant for the fifth time She was not anxious for another baby but accepted the idea without difficulty Her antepartum course was uneventful and her blood pressure remained essentially normal, although occasionally reaching borderline values She was delivered of a daughter without incident

After the birth of the baby her husband's attitude toward money be came even more stringent so as soon as she was able she sought part time work in a cafeteria, working from 6 00 to 12 00 every evening Her husband was delighted that she was doing something to earn her keep ' After working six to eight months she was greatly distressed to learn that she had become pregnant again She realized that she would have to give up her job and, with another child, her husband's haggling over money would become all the worse

She returned to the New York Hospital depressed and worried Her cough and hoarseness became worse and her breathing was more asthmatic in character although she developed no acute attacks of asthma She lost weight throughout her pregnancy and one month before term her blood pressure rose mildly to 150/94 Just at this time

her oldest boy to whom she had become very close now 18 and in the Army was sent to Alaska Her husband had forced her to sign permission for the boy to enlist claiming that the Army would be good for him She went into labor that same day

She was delivered uneventfully of a premature boy one month before the expected date of confinement Shortly before delivery the blood pressure rose to 165/98 but immediately post partum fell to 115/85 She was considered to have had a mild hypertensive toxemia of pregnancy but was discharged six days post partum with a blood pressure of 127/87 Four months later the blood pressure was 130/80 She decided to attend the contraceptive clinic but found that she could not be fitted with a diaphragm

Her new baby did well but she continued to be intensely anxious She developed cramps in the abdomen and perspired easily Arguments about money and the children continued The one bright spot was that her husband had become crazy about the baby' This however did not make up for his lack of interest in the other children indeed his hostility toward them She felt impelled to take their part against their father and, in addition, was worried about her son in Alaska particularly because she was using his Army allotment checks for household expenses rather than saving them for him

Seven months post partum her blood pressure was 140/100 One year later it was 180/110 At this point, another source of conflict arose Their second son now 20 had impregnated a girl of 15 The father was 'furious and wanted to throw the boy out of the house and disown him" The patient however encouraged her son to marry the girl although she did not care for her prospective daughter in law Her husband finally permitted the marriage but would not allow the boy to come to the house when he was there

Because of continued hypertension she was referred to our clinic Her symptoms remained essentially unchanged She was willing to come only at three- to four week intervals and was reticent in talking about her problems Not until after 10 months attendance at the clinic and on an occasion when she was covered with bruises did she acknowledge that her husband had beaten her periodically throughout their marriage

Nevertheless during the first three months of visiting the clinic her blood pressure came down to almost normal levels She was given reassurance and allowed to talk as freely as she could about her problems The financial problem she resolved temporarily for herself by deciding not to worry about using her son s money to help with the household

expenses This avoided considerable conflict with her husband He was *seen on two occasions in the clinic when an attempt was made to help* him understand his wife's problems Although he considered his wife a spendthrift, he agreed *readily enough to co operate by being gentler with* her She said "Since you seen my husband he's been a different man"

The improvement in their relationship was short lived After being indulgent and allowing her to express herself fairly freely for a time he once again became sullen, and angry, stayed out drinking a good deal *and would not talk His behavior* was particularly unpleasant at the time their son returned from military service "My husband is on bad behavior again Saturday mornings he begins drinking, *stays* out all day drinking won't take me out Saturday night and Sunday he stays in bed all day sick from drinking"

A month later the patient's blood pressure was 180/105 and she was covered with bruises 'I think I'm wasting your time and my money My *husband won't come in again*" *At this time the children were quarreling* with their father and the 16 year old daughter had said, "If he keeps this up I am going to waltz out of here ' When the girl graduated from junior high school that Spring her father refused to buy her a graduation dress but went out and lost $15 at cards instead 'That s the way he neglects the kids" ' That's why I swore I d never have another baby and why I had so much trouble when I did get pregnant last time'

During this period the patient felt shaky inside, slept poorly, could not eat for fear of vomiting and even began drinking herself

As abruptly as her husband's bad behavior' had begun, it suddenly stopped He became considerate again and much more tractable Coincidentally the patient's blood pressure returned to near normal levels *Although life was not entirely satisfactory it was tolerable*

Again however the improved situation lasted only a few months and the patient s blood pressure rose The situation at home became one of discord again with the usual quarrels between the father and the children and the problem of money

The patient resumed her drinking, restrained her anger left the room if an argument arose She could see no way out of her stressful life situation and was *attempting to make the best of it Her blood pressure* at the time of her last visit was 170/100

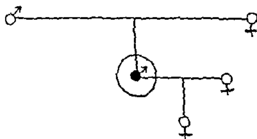
Summary The patient was a dependent initially carefree young woman who married a rigid, unaffectionate man who was often cruel to her She loved her children and her husband, but after her fourth child found her *life unduly restricted especially in view of her husband s*

penurious attitude and his neglect of the family She found a measure of emancipation in a job outside the home where she made her own money and had contact with people Her freedom was suddenly curtailed when she became pregnant again Her resentment toward her husband increased and she developed hypertension in the last month of her pregnancy

After a brief fall to normal readings post partum, her blood pressure rose to sustained hypertensive levels during the next one and one-half years

Expressing her anger was inherently not difficult for her but the fear of beatings caused her to suppress it Naturally a dependent person, she was unable to achieve any semblance of independence by being confined to the house with her baby When her husband was kind to her her life became more tolerable and her blood pressure fell to near normal levels When he was cruel and sadistic her blood pressure rose

CASE 24 *A 50 year old man formerly of a violently aggressive temperament whose hypertension was discovered at a time of a successful resolve to discontinue expressions of anger His rigid defensive manner precluded successful therapy and he died of a stroke seven years after hypertension was discovered and eight months after first coming to the clinic*



The patient was a tall robust looking man with a commanding appearance and a booming voice—*an executive* in the sales department of a large firm He was an only child whose mother had died when he was 8 He was able to remember nothing of her except that she was *beautiful*

His father was a strict domineering and punitive man who once knocked his son to the ground for stealing a dollar The boy accepted his punishment however without question I deserved every licking I got '

As a child he was friendly and outgoing but intensely aggressive and inclined to bully his playmates

When he was 11 his father remarried His step mother was a 'fine woman—better educated than my father," of whom he remained fond all his life, although he never felt very close to her "I think I was happy for my father to marry again," but the chief significance of the marriage was that "It gave me a playmate 1½ years younger than I—a namby *pamby I could dominate I was the rougher one and I'm sure I made my* step brother the stool pigeon for me"

The patient's schooling was interrupted at the age of 17 when, because of suspected TB, he was required to take a modified rest cure on a farm He had planned a carreer in engineering and took this interval as a serious handicap

At the time of his discharge from the farm he was tense and dissatisfied He decided to enlist in the Army (World War I) He did well and was made a sergeant in three months He saw combat in France for several months and was then transferred to the Officer Candidate School He then became a 2nd Lieutenant in less than a year of service For the remainder of the war he served as instructor in the Officer Candidate School

On returning to the United States he took a job as cashier in a wholesale produce house

Again, however, he became tense, afraid of crowds and closed places and felt too restless to sit through a movie His family physician told him he was having a nervous breakdown and sent him off to the farm again *This time he stayed only five weeks, occupying himself* with dynamiting stumps out of a field He obtained a tremendous emotional satisfaction from the blasting He soon felt himself again and was able to return to work in the produce house

At the age of 25 he married *He had* never been consciously *much* preoccupied with sex or women and said he had never masturbated He had a few dates with girls while in high school but was shy and never considered himself in love He met his wife during his stay on the farm and was not particularly attracted to her at the time but married her after his second visit, "mostly because of her proximity" In later years he said "I never had firm attachments to her even when we were first *married*"

His introduction to sexual activity was disappointing He found his wife "cold" The marital adjustment was further complicated by the fact that while he wanted children his wife did not

In this setting, two years *after their marriage the patient* set up an extra marital affair which he found sexually satisfying but fraught with

guilt The affair continued for several months 'Till my wife found out about it I made a clean breast of it and my wife was more attentive thereafter From then on she permitted intercourse whenever he wished, although she never gave him the feeling that she enjoyed it She also consented to have children and became pregnant The first pregnancy resulted in a miscarriage at seven months Two years later she became pregnant again and their daughter was born

His wife was a quiet kindly comfortable' person but unlettered and unambitious She always tended to be overweight deplored it constantly and yet never tried to do anything about it Her English was poor, and the patient found this acutely embarrassing whenever he tried to impress his business associates She is willing to do anthing for me or my daughter She has a temper only when pushed by hard abuse Usually only after I rib her for a long time just for fun No other woman would have put up with me

In his climb up the social and economic ladder the patient found his wife to be more and more of a handicap comfortable' as she might be at home Although he frequently corrected her, she made no attempt to change This was a constant source of embarrassment and resentment for him

The patient considered himself a religious man and all his life he maintained his membership in his old home town church even though he did not maintain a residence there He was a Baptist and although he only went to church about once in two months he gave generously throughout his life and prayed every night I have feelings of what I want from going to church a feeling of uplift and personal improvement I don't want a minister to preach over my head or down to me' His wife had little interest in religion but attended church with her husband

The patient spent seven years on his first job rising from cashier to general manager within a few years During this time he took a four year law course at night After the seven years he saw no future for himself without a change in his job and so he quit He quickly obtained work as a sales engineer with an engineering firm He did very well and received frequent promotions for the next five years Then abruptly he was fired in 1932 because of bad business conditions but was able to get another job in another division of the same company This job entailed much traveling which he enjoyed and again he did well taking on more and more work and receiving several promotions in salary Despite his rapid advancement he continually felt the need for praise from his superiors He became hurt and resentful if he did not get it

He also applied for a veteran's pension on the basis of the nervous breakdown he had had after his discharge from the Army Earlier he had spurned the idea of applying, but seeing so many people get what he considered undeserved pensions persuaded him to try to get his share He received a 10 per cent disability on the basis of a nervous breakdown When these pensions were all cut off he developed an extreme bitterness toward Franklin Roosevelt which 20 years and an eventual salary of $20 000 a year did not erase He felt that something that was his due had been taken away unjustly and just at a time when his security in his job was threatened

About this same time his father became ill with cancer and had to be put into a home for incurables, where he lingered for two years, his son paying for his care Every time the patient went away on a trip he was not certain whether he would see his father again His father eventually died while he was away, just as he had feared In the same year, 1935, his father in law went bankrupt and had to move with his wife into the patient's household He was helpful and pleasant but the mother in law was domineering and highly critical of her daughter Although her husband died in 1937 she continued on, a constant source of harassment to the patient and his wife until she finally died in 1951, at the age of 90

For two years after his wife's parents moved in, the patient had trouble with his stomach and was told that he had "ulcers" "I always had low blood pressure which made me tired all the time" His blood pressure was checked at least yearly from 1932 to 1942 for insurance purposes and was always found to be in the range of "109 to 110"

Hypertension was discovered in 1943, when he was 47 years old, in a setting of his feeling unappreciated by his firm because of his failure to get a promotion and a change in attitude toward his daughter who was going off to college An intelligent girl who always did well in school she had been a great source of satisfaction to him He particularly enjoyed the feeling of guiding her thinking We understood each other We were so close that we didn't need to talk '

At the time of a contemplated move to another city the patient's daughter was 18 years old and was fast becoming an independent young lady She now tended to do her own thinking and to reject her father's control Previously, when she tried to rebel against him, he slapped her or punished her physically to let her know who's in authority around here" Now, however he did not feel able to do this and decided to control his temper He felt that it was foolish and childish to express anger "I gave my daughter credit for that"

With his daughter away at college he felt deprived of companionship If she never gets married it won t be too soon for me I ve traveled on the road for 30 years and most men are bums No one is good enough for her Marriage would be a let-down in her standard of living She s always had everything she wanted When she was 27 the patient said with pride and satisfaction She has turned down 16 proposals of marriage!'

For the next six years his blood pressure was checked about three times a year and remained in the neighborhood of 180 systolic Occasionally he had occipital headaches but these were never a serious problem At the age of 51 he had a cholecystectomy for stones He became conscious of being more and more tired His favorite sport and relaxation had always been trout fishing but even this became an effort His daughter graduated with honors from college He felt resentful of his own lack of a college degree and felt that he needed to prove to his daughter that he knew a thing or two She enrolled in nursing school which kept her away from home more than college had

Now 52 years old a salesman all his life the patient found the job of selling more difficult He still had to travel His old resentments continued as before and he felt very sorry for himself He became more and more irritable toward his wife and when she retaliated he felt hurt and even more sorry for himself He decided to change jobs again and accepted one which appeared to be a promotion In his new job however he did not do as well as anticipated This brought on him the active disapproval of his bo s which he found hard to take The boss is a year younger than I am He was born with a gold spoon in his mouth

At about the time he moved back to New York he began to have a constant mild feeling of dizziness alleviated only when lying down One year later he had a transient left sided hemiparesis which lasted for a half hour Although he made a full recovery from this he felt unsteady on his feet and always felt that he was falling to the left This episode prompted his referral to a psychiatrist his blood pressure having risen to a high of 240/140 He continued under psychiatric care three times a week for six months Although he was earning $20 000 a year he felt the cost was too great and he discontinued it despite the fact that his blood pressure fell at times to 170/88 Of his psychiatric treatment he said 'I don t feel I learned anything about myself She (the psychiatrist) told me I m a super-ego I always try to do the best I know how and if criticized I m easily hurt such that I feel like crying

He began to take his wife with him on his frequent business trips because he felt insecure by himself He let her drive the car for him 'I used

to love to go into a man's office to make a sale, it was a contest Now it is no longer a thrill I'm so exhausted when I get through My tongue is sore and dry I could take a drink every minute I find myself saying words that make no sense I have to stop myself "

When he was 55 years old he came to the New York Hospital, tired of feeling so bad all the time, fearful of his blood pressure and of becoming a chronic invalid

On physical examination the blood pressure was 240/130 The fundi showed increased light reflex of arterioles with marked arterio venous nicking The heart was not enlarged and rhythm was normal A2 was accentuated and there was a soft systolic murmur at the base The re mainder of the examination was unremarkable

His urine was negative, blood urea nitrogen was normal Urea clear ance was 84 per cent An intravenous pyelogram was normal The electro-cardiograph showed a left axis deviation with heart in a horizontal position The *T* waves and *RT* segments were slightly abnormal, sug gesting early left ventricular hypertrophy

The patient was seen for a total of 19 visits over a seven month period There was no significant change in his blood pressure Within two months a small hemorrhage was noted in his left fundus One month later for what his employer called 'incompetence' he was allowed to resign his job for reasons of health ' It became apparent with repeated inter views that his view of himself and the world about him could not be changed He felt sorry for himself He felt that he had expended himself working hard all his life and that the world had treated him very badly and he resented it bitterly His wife could not speak English correctly his daughter had rejected him, American society was going to the dogs under the Democrats and business had fired him

A month's vacation made him no better despite sleeping 12 to 14 hours a day He was finally admitted to the hospital because of the ap pearance of nystagmus and staggering gait Hospital study included electroencephalogram, skull x rays and spinal tap and these indicated nothing other than progressive hypertensivecerebrovascular disease Within a few weeks he had a cerebrovascular accident and died four days later Permission for autopsy was not obtained

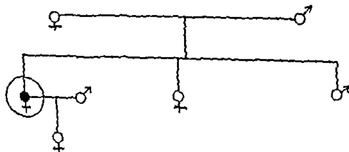
Summary This patient was a 55 year old successful salesman Having lost his mother at the age of 8 he was brought up by a stern, demanding father whom he dared not question and whose corporal punishment he accepted as his due Always anxious for approval and always ambitious, he did well in high school but was forced to leave college because of tuberculosis Recovering from this he did well in the Army in the First

World War but on resuming civilian life had a transient "nervous breakdown" He recovered from this within five weeks on a farm dynamiting tree stumps out of a field

At 25 he married a woman "because of her proximity" He never felt that she was his equal socially and intellectually He compensated by developing a close relationship with his daughter, whom he tried to guide and dominate at the same time After 15 years as a successful salesman with a single company he was "passed over" for sales manager At the same time his daughter began to display an unwillingness to accept his domination He became a great deal more restrained and curbed his formerly freely expressed anger "I gave my daughter credit for that" Having become very dependent upon his daughter he wanted her approval and yet resented her independence of him

Up to this point yearly blood pressures were normal After this at the age of 47 his blood pressure was elevated He bitterly resented the way his company had treated him, yet "I could blame no one" He felt sorry for himself He accepted another job highly paid which involved terrific pressure and responsibility His daughter went off to college and he was left alone with his wife For nine years his blood pressure climbed He became chronically fatigued his performance at work fell off and he was finally discharged for incompetence He died of a cerebro-vascular accident three months after that

CASE 25 *Hypertension appearing during pregnancy in a once volatile and explosive woman who had felt the need to suppress anger and become a model of conformity Some symptomatic improvement was achieved with gradually increasing insight and the gaining of some independence*



The patient was a short plumpish young woman with a pleasant appearance who flushed easily and sat tensely on the edge of her chair She was born in New York City in 1919 the eldest daughter of ...

ents The father was a quiet, seclusive tailor who had few interests He occasionally scolded his three children but never beat them "He always expected you to do the right thing without explaining what the right thing was We were a bit afraid of him" He left the running of the house and making of decisions to his wife She was friendlier than her husband, but tense and highstrung, a neat meticulous woman who insisted that her children keep their clothes clean There was a sister two years younger and a brother five years younger than the patient The parents treated their children with studied impartiality, insisting on neatness and punishing them for minor infractions

The patient said she was always a "good girl" She was shy, always anxious to please, and eager for approval and was easily upset by arguments or unpleasantness She said she never had temper tantrums and never attempted to rebel in any way "I never lost my temper I just boiled inside My father loses his temper, my mother loses her temper, my sister had temper tantrums but I always felt that control of emotions was more sensible"

This was the picture that she drew of herself as a child However, an old friend of her's recalled that she was known as a fighter among the neighborhood children Her intensely aggressive behavior was a source of complaints from parents of her associates Even when faced with the evidence the patient could not remember having been openly aggressive In any case, at the age of 10 or 11 she changed her pattern completely and became compliant and docile

The patient liked school and did well, always remaining in the top one third of her class She made friends easily and never had trouble with any of the teachers In junior high school she skipped one grade and continued to get her usual high marks It was in this early school period that she formed the friendships she was to continue throughout her life In fact, at the age of 5 she recalls playing with six of the neighborhood girls in someone's back yard Her friendship with these girls was never broken, though their lives later led along divergent paths When she went on to high school and college she formed no new friendships but stuck with her childhood friends

She graduated from college at the age of 20, planning to become a teacher Though she enjoyed the academic aspects of college, she led an isolated existence there She entered none of the extracurricular activities, made no friends, and always returned home as soon as her classes were through for the day She wanted to teach and this was the sole motivation for her college carreer

Since the early 1930's was a time of economic depression she began part time work at a department store while she was still at college to help her family financially. On graduation, though she passed her teacher's examinations for the New York City School system without difficulty, there were no openings for new teachers. She obtained full time employment as a salesgirl. She did not enjoy this but after a year when she was put in charge of a section with a raise in salary she then found the work more to her liking. She became friendly with her fellow employees but never made them part of her personal life. Indeed after she left six years later to have a baby, she never saw any of them again.

She began menstruating when she was 12 years old, having heard about it from girl friends beforehand. "I was a little proud, a sign that I was growing up." Her mother also told her that it was normal thing and nothing to be ashamed of, but gave her no more information concerning sex. She began dating boys at 15 but this was an infrequent occurrence until she was 18. She enjoyed a moderate amount of kissing and necking. She met her husband when she was 13, as he lived in her neighborhood, but did not begin to go with him until she was 18. He was her first real love and even after 15 years of marriage she had no occasion to regret her choice. He was four years older than she.

Her husband had been born in New York of a Hungarian born mother and a Russian born father. He had finished elementary school and at age 15, because of the death of his father, had gone to work to support his mother and sister. At 19 he was a house painter. Because of the relative insecurity of this kind of employment, when the opportunity for a civil service job arose he took it, becoming a subway conductor for the New York City Board of Transportation at the age of 34.

Though her parents had not been enthusiastic about this prospective son in law, they did not enter any serious objections to the marriage and accepted him readily enough. Right from the start the patient was pleased with the marriage. Sexual adjustment caused no difficulty and intercourse was mutually satisfactory. For economic reasons they deferred pregnancies and she continued working.

The patient described her husband as "a jewel. . . . He's wonderful." He was an adequate provider, conscientious, did not smoke or drink, had a good sense of humor and was quiet and easy going. He was always thoughtful and considerate. In his words, "Her mother and father objected to me in the first place. She's a college graduate and I'm uneducated. But we thought enough of each other to get married." Despite the

difference in education the husband had intellectual interests, read extensively and kept himself well informed The patient always stated that she never had occasion to feel embarrassed by her husband s lack of education

Both she and her husband had been brought up in the Greek Orthodox Church and they were married *in this church After their marriage they* attended church only irregularly, although she occasionally felt the need to pray, which she did when she was upset

Three years after their marriage when they felt ready for a baby she became pregnant I was very happy Maybe I was little frightened at first I had no morning sickness or backache " During this time she began to ruminate about her mother's high standards for her when she was a child and determined not to do the same with her child At seven months her blood pressure rose, at eight months she developed edema of the face and ankles, together with albuminuria During delivery she had two convulsions Two weeks later upon her discharge her albuminuria and edema had cleared up Her blood pressure however, never returned to normal, except for a two week period following an emergency appendectomy when she was 28 years old

For the next five years she stayed home taking care of the baby Though she had wanted more children she accepted the doctor s advice that she should undertake no more pregnancies She tried to occupy herself with housework and with visiting her mother, brother and sister When her daughter was old enough to go to school she applied for a permanent license to teach but could not pass the physical examination because of high blood pressure For the next five years she taught with a substitute teacher's license, always dreading the day when she would be called up for another physical examination, which might force her to *discontinue teaching permanently* She *enjoyed the teaching* despite this and enjoyed working with the children She never felt nervous or tense in class and only occasionally became impatient with the children *When the principal of the school sat in the class, to watch, however,* she did become anxious so that her neck and face flushed She was confident that she did her work well but was fearful of criticism

Her parents shared an apartment with their other married daughter and when she left to join her husband in Europe the patient and her husband moved in This proved to be an unhappy situation I felt like a child again " *Her mother was critical of the way in which she ran her* household and brought her daughter up The patient pushed herself "quick quick quick all the time," to try to do work before her mother

and thus forestall her mother's complaints Moreover she felt guilty whenever she left her mother alone in the evening

The long awaited physical examination came in November 1950 after five years of teaching Her blood pressure was found to be so high (205/130) that she was sent to the New York Hospital for treatment On admission to the clinic, physical examination revealed areas of spasm in the retinal arteries but no other changes except the elevation of blood pressure Electrocardiogram chest X ray and urinary studies were also unremarkable

Despite the paucity of her symptoms the patient came to the clinic faithfully in the hope that her blood pressure might return to normal, because she wanted to be able to pass a physical examination for the Board of Education Some of her remarks concerning herself follow "I never like to see anyone fighting or screaming I always like to feel it can be controlled There are two sides to a question always it can be talked out Then as if recognizing her defences she added lightly, I guess I'm just perfect She was particularly sensitive to criticism from the parents of her pupils I feel the parents should understand right away I think I get angry for a few seconds and then talk myself out of it right away I don't show it We part friends Then it bothers me for a few days"

To add to the difficulties the patient became involved in a dispute between her husband's parents and her own Her mother was particularly critical of her apparent partiality to the husband's parents Long standing premenstrual headaches became more intense and more frequent and she developed a feeling of tightness in the back of the neck She began to cry after she went to bed at night and had a recurrent dream I'd walk into a strange building without windows I'd get panicky wake up and be happy it was all a dream then drift back into the panicky state not knowing where I was or where a window or door was" This dream recurred once a month for four or five months but she told no one about it The family quarrel between her mother and her in laws was now at its height and culminated in the decision of her parents to look for another apartment Before this they could have left and it would not have upset me now if they leave I'll feel so guilty I know we would be better off if they did leave

Another constant source of annoyance to her was her mother's criticism of her daughter Mother gives me a list of things my daughter has done which she thinks are bad I believe in letting my daughter do more When I was a child I was not allowed to mess the place up It annoys me that my mother tells me this

She began to remember dreams, though previously she had only rarely been aware of dreaming "I was sitting in a subway, it was dark, an air plane was strafing the train A man was on my right and a woman on my left, everyone panicky except we three A bullet kills the man on the right, wounds me in the abdomen, does not touch the woman on my left People helped me up There was blood in back of me

"I was in a classroom, trying to change things Before I knew it I realized I was screaming I cautioned myself The kids were not going about their proper business I lost my temper I don't know what I said I kept telling myself to be cautious Anyway, I was a failure and could not get my ideas across

"I was taking care of someone's baby I'm trying to make the baby comfortable with his head in the crook of my elbow No matter how I fix it the baby's body is out rigid"

After the patient had been coming to the clinic for three months she said, "I just don't like the idea of having my blood pressure taken If I hated it enough I wouldn't come but I do come This is a new approach I know there is nothing physically wrong it is my way of thinking and reacting, yet nothing changes Back of it all is my license, otherwise I wouldn't come every week I resent coming If I read a law I always try to follow it, so I make myself come and resent it I never make a rebel lious decision Years ago I used to wish my mother and father were of more help to me I think that somewhere along the line something must have happened but I don't recall what it was"

As she talked more about her mother she became better able to ex press feelings about her mother My relationship with Mother has changed in the past three years Familiarity breeds well, I brush her off when she bothers me" At the same time the relationship between the two became less strained

Shortly after that the mother had the grippe but refused to have a doctor called 'Every time my mother turned in bed she groaned and sighed and refused any help Maybe I think it is a form of criticism (from mother) and I don't like criticism" One morning the mother became excited and unmanageable saying she was much worse I was very annoyed I told her that was no way to act It s very unusual for me to talk back to her like that I think she really needs to be spoken to but I still feel very guilty"

"I remember when I was 8 or 9 years old I did most of the shopping Mother sent me for a bottle of milk I dropped the bottle Mother said I wasn't dependable and she spanked me I thought she was very cruel

I hadn t thought of this for years till three or four years ago I was think ing of sending my daughter on an errand and hoping I wouldn t be like my mother in that regard The relationship between my daughter and my husband is so free and easy, so different from me as a child with my parents Discussion of this brought tears to her eyes ' I don t know why nothing else does

After the parents moved away her headaches became less frequent, she became less irritable the flushing of her neck became infrequent but there was no fundamental change in her relationship to her mother Her blood pressure remained elevated She continued to have dreams of violence death gunshot wounds etc But I don t like violence I felt like losing my temper but of course I couldn t '

She did not return to the clinic for a year and then only in response to our request Her blood pressure was still 186/110 She had lost her license to teach the grades the month before I was good and mad ' but she still retained her license to teach kindergarten subject to one more physical examination Things are going along as usual I see my mother once a week It is much better living separately *We are good friends* There is nothing to make me deliriously happy nothing that makes me unhappy I think I ve gotten mad four or five times but I don't really lose my temper It passes in five minutes

All day I m a jump ahead While finishing one job I m thinking of the next yet no one is rushing me At school I can sit back and *relax*

I don t miss my mother that s for sure Half the time I *m* anxious to see mother the other half I go because I think I should '

Ten months passed before she was again seen at our request A de tailed physical examination was unremarkable except for her blood pres sure of 170/100

Though her blood pressure was still elevated it was apparent that she had done a lot of thinking about herself and her way of doing things She had gained some insight and was able to understand her own emotions better but she was not as yet able to effect any fundamental changes in herself

She was seeing her mother once in one or two weeks I think of seeing her every day then I forget it When I go it s a duty call When I see her I don t feel comfortable *We make* small talk I watch the time and after one hour I go I m more independent of her She doesn t like where I go in the summer I used to go away on vacation in the summer with her, in the last two or three years I ve *waited* till the last moment to tell her I was going feeling very guilty because I knew she wouldn t like it This

year I said, 'You're not going to like it but I'm going there,' without feeling guilty "

She also recognized that she was frequently annoyed—at least four or five times a day "I don't really get angry I keep thinking and planning ahead, not enough time to do everything I get really mad one or two times a month before my periods I don't really express my feelings, I just say a sentence or two

"I got mad and shouted at a stubborn little boy at school and thought, 'getting mad is not going to help ' " She also began to realize that there were things about her husband which she resented At this writing it is felt that she is still making progress Perhaps with more frequent visits to the clinic a more fundamental change may be effected

Summary The patient is a woman of Russian born Greek Orthodox parents, who developed hypertension at the age of 26 in the seventh month of her only pregnancy Her blood pressure never returned to normal thereafter She recalled herself as being a docile, shy, good girl who never lost her temper or rebelled in any way She did not recall that she had gotten into frequent fights with neighborhood children up to the age of 10 or 11 and that the neighborhood parents all complained about her aggressive behavior

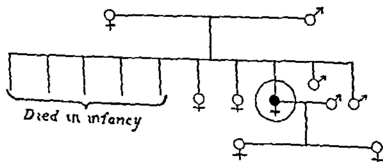
She considered herself close to her mother, tried to please her and felt under pressure all day long to do things quickly and to plan ahead, in order to avoid possible criticism She felt guilty if she displeased her mother When she was 31 her parents came to live with her and her husband and she felt like a child again

After five years as a substitute teacher, she was told by the Board of Education that unless her blood pressure dropped to normal her license to teach would be revoked At the age of 36 she came to the clinic for treatment

For six months she came once a week to the clinic and one or two times a year thereafter At first she was unable to recognize any hostility in herself or her dependence on her mother She did realize than even minor decisions which showed some independence of her mother made her feel guilty In time she came to realize that she had never actually been close to her mother and, after her mother and father obtained their own apartment she found that she went to see them only from a sense of duty On the surface she became better able to be more independent, with less guilt but, although she could now recognize her resentments, she was not able to express resentment with any facility

As a small child she had resented her mother's constant criticism and punishment For a while she was able to express her resentment by beating up the neighborhood children From the ages of 11 to 26 she made a tolerable adjustment by model behaviour and by doing well in school and at work and in her marriage In all this time however, she restricted her friendships to ones found in early childhood and sought nothing new which might have incited her mother s disapproval When at 26, she was about to have a child of her own, the conflicts of her own childhood were reactivated She was determined that her child was not going to be treated as she had been This meant open rebellion against her mother and was much more difficult to suppress She developed hypertension For the next 10 years as her daughter grew up and was allowed to develop without restrictions the patient felt more and more guilty because of her suppressed resentment against her mother, which was made worse when her mother came to live with her After three years in the clinic she was just beginning to get some insight into these matters Her blood pressure was still elevated but it is hoped that further therapy might effect improvement

CASE 26 *Hypertension associated with depression in a 48 year-old woman whose blood pressure apparently maintained at levels higher than 170/110 for 11 years reverted to normal in association with freely expressed hostility to her husband Following divorce and remarriage her blood pressure remained normal for more than two years*



The patient was a short buxom woman who from a distance appeared relaxed motherly and warm In conversation however she was forceful and positive but in a very polite and affable way

She was born in Russia the eighth of 10 children The first five siblings

died in infancy, making her, in effect, the middle of five children, there being two sisters 12 and 8 years older and two brothers 5 and 3 years younger

Her father was an only son of an Orthodox Jewish family He was a well educated, scholarly, religious teacher who had scarcely any financial ability at all His attributes made him well respected in his native community, but failed to achieve this for him in New York City He took refuge from the strife of daily living by being "sick all his life," according to the patient and at the age of 56, when the patient was 13, he died of asthma

Her mother was a pretty, but domineering, unhappy woman, who made all the family decisions It was she who decided the move from the Ukraine to the United States She came alone and after four years sent for the family The parents quarreled about their financial difficulties and their sexual relations The mother was bent on avoiding further pregnancies She died of pernicious anemia when the patient was 18 years old The oldest sister took on the responsibility of caring for the younger children and was a source of emotional support as well to the patient

The patient was a frail, sickly child In addition to the usual childhood diseases she had pneumonia seven times before she was 10 years old She was frequently boarded out" with non-Jewish families where the Jewish dietary laws did not prevail, in order to be "fattened up" In her home, food was never plentiful

She was always the father's favorite My father raised me to be a prima donna I was not destined to work " Of all the children the patient was the only one who received piano lessons despite the poverty

On her arrival in New York at 12, she started school for the first time, Jews having been excluded from school in Russia In three years she completed five grades of grammar school, enjoying school and doing well but at 15, she was forced to get her working papers and go to work I was miserable, working in a sweatshop I was no longer a prima donna " For two years she worked in the sweatshop, then got a small clerical job on a newspaper For three years she had two of these jobs in succession but was fired from each one when it was discovered she was Jewish 'I was unhappy shy and terrified of people '

The patient was slow to make friends and contacts outside her family An attractive girl, she was too shy to accept invitations from boys for dates until she was 17 Even then she dropped any boy forthwith who attempted to kiss her She knew very little of sex and what she did know

made sex seem disgusting to her When she was 13, at a time when she shared a bed with her sister she was awakened one night to find her sister having intercourse with a boy friend Her sister repeated this several times during the next month much to the patient s shock and revulsion At 14½ she began menstruating without any previous knowledge Her sister told her, "Now you're in for it" She never had pain or discomfort with her menstrual periods

When she was 20 years of age she met her future husband who was the same age He was the youngest of seven children born in Poland, a shy and timid boy who had few friends

The patient felt with him a common bond of loneliness Both were inexperienced sexually Sexual intercourse which was attended by fear and guilt resulted in pregnancy so they were married

The marriage was not a happy one He was rigid demanding and penurious She disliked to quarrel and gave in to him to keep peace in the family She had witnessed constant quarrelling between her own parents and she had resolved not to let her marriage follow this pattern

The patient became less shy as she grew older found that she made friends easily and that she was considered desirable company by her friends Her husband however was always critical of her friends and made them feel unwanted in her house

She was very anxious to have more children but he was fearful of being unable to feed them so he practiced withdrawal in sexual intercourse as a means of preventing conception

At age 29 following a cholecystectomy and an appendectomy, she became depressed for a period of two months After a spontaneous recovery she became more aggressive with her husband and insisted on having another baby A second daughter was born This was during the economic depression Also despite her husband s objections she became more active outside the home She participated in community affairs and took part in relief activities

Five years later she became depressed again feeling caged in " After spending eight months in the country she felt able to return to her active life in the community At this point her husband lost his job as a dress cutter and it was she who applied for relief

Four years later their older daughter married The patient approved, her husband did not and again there was terrific tension in the house Nasal congestion and rhinorrhea developed and two years later at the age of 41 the patient came to the New York Hospital for relief Shortly afterwards a uterine hemorrhage occurred requiring admission to another

hospital for treatment and a radium menopause was induced A vaginal plastic operation was performed at the same time

She returned to the New York Hospital with severe menopausal symptoms (hot flushes) and an exacerbation of the pain in her joints For two years she was a regular attendant at the Arthritis Clinic, where hormone replacement therapy with stilbestrol gave her considerable relief from her hot flushes and joint pains

When the patient had married she was a thin, small girl She had steadily gained weight throughout her married life so that she was quite obese by the time of her first appearance at the New York Hospital, weighing 77 7 kg (height of 150 cm) In later years she was not infrequently aware of insatiable hunger and compulsive eating Her blood pressure at the time of her first visit in 1941 was 160/90, pulse, 96 The nose showed a pale, congested mucosa with a clear, watery discharge The remainder of the physical examination was entirely normal A second blood pressure a few months later was 170/100

Her life at home did not improve Her husband had again found employment and her activities outside the home were curtailed not only by her physical symptoms, but also by the lessened need for her community activities He was again more critical and demanding Sexual relations continued to be unsatisfactory

Two years later financial insecurity led the couple to take over a small business in the South This experience was a failure They found themselves taking advantage of the Negro customers despite the patient's feeling of sympathy and distress for their underprivileged status Moreover, the patient felt that the long hours at the store were forcing her to neglect their 12 year old daughter She suddenly became intensely depressed and began to have episodes of feeling faint At that time she was told her systolic blood pressure was 220 After three years in the South she returned to New York to live with friends, leaving her husband behind Her oldest daughter, now married took over the care of the younger daughter

Two years later the family was reunited in New York The earlier problems were intensified by virtue of the hostile contentious attitude of the younger daughter The patient feeling guilty over her failure as a mother, became depressed again and again sought help at the New York Hospital in 1948 when she was 48 years old

Additional symptoms were diarrhea, rectal pain and bleeding hot flushes, headaches and a sense of inner trembling Blackout spells re

turned and her depression deepened She lost interest in her surroundings and became unable to concentrate She thought of suicide

The eye grounds showed minimal arterio-venous nicking but were otherwise normal The heart was not enlarged, normal rhythm was present with heart sounds of good quality There was a soft apical systolic murmur which had been present in 1941 The lungs were clear except for medium dry rales at the right base posteriorly, which remained unchanged throughout the subsequent five-year period The abdomen was normal except for the cholecystectomy scar in the right upper quadrant Rectal examination revealed external hemorrhoids and an anal fissure The remainder of the examination was normal

In the laboratory a blood count urinalysis and Mazzini were normal The electrocardiogram was normal The chest x ray indicated slight enlargement of the left ventricle but was otherwise normal A barium enema was normal A proctoscopy confirmed the presence of a fissure in ano

She was referred to our clinic which she attended for five years at first at weekly intervals She was allowed to talk about her problems was given emotional support and reassurance and a correlation of emotions with her blood pressure and other symptoms was attempted At the beginning of each interview the blood pressure was recorded in the supine position in the right arm The pressure was recorded repeatedly over a period of several minutes until the readings had stablized It was not uncommon for the pressure to fall 20 to 30 mm systolic and 10 to 15 mm diastolic in that period of time At the outset the pressure ranged in the region of 190 to 200 systolic over 100 to 115 diastolic In the last year the level ranged from 135 to 160 over 80 to 90 When she first came her main concern centered on her younger daughter s rebellious attitude After one year in the clinic her blood pressure was 170/90 and her depression was unchanged She continued to have headaches and blackout spells It was formulated to her that her depression was endogenous and that it would lift eventually She accepted this formulation without comment but two days later wrote an explosive letter to the effect that her husband was the cause of her troubles that she had known it all the time but had pushed it to the back of my mind in order not to face it She decided to divorce him This decision was not encouraged by her physician but she was advised to express her feelings directly to him i e lose her temper She found this almost impossible to do For the first time she recognized the effect on herself of the constant bickering between her own

parents and her early resolution not to repeat the same pattern in her own marriage She also felt foolish at the idea of expressing anger over incidents that might have occurred 10 to 20 years earlier but about which she still felt strongly

Once she did engage in an angry outburst The following day her blood pressure was at a new low—154/88 Though her husband had been warned of this previously and had been advised to encourage her to let her express herself, he was unnerved by the experience He became afraid of her, avoided her and took pains not to be left alone with her She went around with "murder in my heart," and was actually afraid she might harm her husband She was still depressed and became alternately pre occupied with suicide and murder

After a few months of this she developed a severe epigastric pain, un relieved by sedation, hourly feedings of milk and cream, or by alkali

The next eight months was a stormy period At times they got along quite well, even to the point of enjoying mutually satisfactory sexual relations for the first time in their married life Most of the time, however, the patient was intensely critical of her husband She developed periods of insatiable hunger, when food would give no relief, and bouts of diar rhea alternating with constipation, associated with bleeding hemorrhoids On one occasion she developed a fecal impaction which had to be broken up manually Blackout spells and palpitations continued Occasionally when she managed to express anger at her husband her blood pressure fell to the neighborhood of 152/88

She also developed vaginal bleeding which required admission for a dilatation and curettage The pathological finding was benign hyper plasia of the endometrium While in the hospital the blood pressure fell to a new low of 110/74 On returning home she was 'frustrated and afraid", the blood pressure again was 175/100

In the meantime her second daughter was contemplating a marriage totally unacceptable to the patient's husband Arguments over this pre cipitated a decision on the patient's part to leave her husband, which she did shortly after the wedding The daughter was already pregnant and needed help in her new home because of a persistent vaginal bleeding The patient moved in with the couple, but the daughter remained an explosive rebellious person The new atmosphere remained difficult for the patient until after the child was born, at which point she felt free to express herself to her daughter Her blood pressure fell to 145/85

It is noteworthy that despite her personal difficulties and her many physical complaints, the patient was always able to make friends and to

keep them Throughout her difficulties she always maintained a sense of humor except in the depths of her depression People seem to like me They like to talk to me and hear what I have to say '

She had an attack of flank pain, characteristic of renal colic, and was again admitted to the hospital for study The blood pressure was 155/85 A complete physical examination revealed no new findings and laboratory tests including an intravenous pyelogram, were normal

Discouraged and depressed she thought of returning to her husband, but after seeing him a few times her blood pressure rose to 190/105 and she was advised not to see him again In three weeks her blood pressure was again 140/80

Shortly after that she met a man a few years her senior, a widower, What I've been looking for all my life, an intelligent, refined kind, tolerant person Interest was immediate and mutual I felt at home with him ' She divorced her husband and remarried

The adjustment to her new life was not altogether smooth Her husband a chicken farmer was in severe financial difficulty much of the time At times she was depressed Nevertheless in her new and warm relationship with her second husband she expressed herself freely and for the next three years of observation the blood pressure ranged between 125/70 and 140/80

Summary The patient had grown up in an atmosphere of family strife and insecurity which engendered an attitude of bitterness and hostility, balanced by an overriding determination to keep the peace Added to this was a dependent nature in need of support which her first husband was unable to give She felt unable to even express *opinions* to him Her life seemed devoid of satisfaction Resentment built up over a period of 30 years Hypertension depression and a host of other symptoms developed

Through the five year period of her attendance at the clinic she learned to know a good deal more about herself and her way of dealing with her life situations She was able to become independent enough to separate from and divorce her husband Her dependency needs were not and could not be adequately satisfied by her daughter nor by the clinic but she was better able to express herself Indeed direct expression of her resentment on many occasions was *associated* with a fall in her blood pressure

Finally she was able to find a man who fulfilled her ideas of what a man should be and who was able to fulfill her dependent needs In making her adjustment to this man she was able to learn from her previous

experience in that she expressed herself directly, even if prodded by the development of symptoms, thus avoiding the necessity of repressing her feelings She also learned that expression of feeling and of differences of opinion was not necessarily a catastrophic occurrence Although she can not be said to be a well adjusted woman, she has come a long way toward learning to live with herself The most striking result, however, is the establishment of normal blood pressure in a patient who had been hypertensive for many years

SUMMARY

Our survey and follow up study of 114 patients with essential hypertension is in substantial agreement with other published series It is the general concensus that it is a disease which begins in the first half century of life that there is a predominance of women and that the symptoms, although quite characteristic of the condition, have little to do with either the height of the blood pressure or the rate of arterial or arteriolar degeneration More striking, it appears that neither the height nor duration of the elevation of arterial pressure provide a reliable indicator of severity or prognosis Unaccountably some patients lose their evidences of hypertension, even after years of known high blood pressure Possible explanations for this and considerations of treatment will be presented in the next chapter

A study of personality adjustment among the patients with hypertension did not delineate any characteristic personality "type", but yielded strikingly similar data as regards values, attitudes and way of life By and large the hypertensives had grown up feeling the need to excel but at the same time to avoid conflict or too vigorous self assertion These strivings, often opposed as they were, led frequently to dilemmas and were manifest by wary, tentative and non committal attitudes with respect to important interpersonal relations and major endeavors in life

In the present series the 12 per cent of patients who lost all evidences of hypertension appeared to have developed a more confident and relaxed approach to life, a more optimistic outlook, and an improved capacity for self assertion

CHAPTER IX

TREATMENT OF ESSENTIAL HYPERTENSION

AN APPRAISAL of the results of treatment in essential hypertension is difficult because neither the level of arterial pressure nor the presence or absence of symptoms reflects with sufficient reliability the course or outcome of the disease in any given subject Thus the goals of therapy are not immediately obvious One might reasonably attempt to prevent the development of atherosclerosis to modify the height of the blood pressure or to alleviate the incidental symptoms that a hypertensive patient may have such as headache giddiness sleeplessness or muscle tension Up to the present, most therapy has been directed toward lowering peripheral arterial pressure although it is still not certain that lowering the pressure is capable of shortening the disease process or of alleviating symptoms if they exist

In this connection the results of the study of Hoobler s group referred to earlier (65) are of special interest Hoobler reported on the records of 117 patients at the University of Michigan whose initial diastolic pressure was 110 or higher At the end of the 10 years 50 per cent of the patients were still living The initial height of the blood pressure bore no relationship to the survival rate or to the development of vascular complications Another interesting point was that the level of blood pressure in these patients once established tended to remain in the same range until death Those who developed vascular damage continued to display a blood pressure approximately within the same range over a period of years but so also did those who did not develop vascular damage

It may be that aiming treatment at lowering the level of blood

pressure is justified by the fact that congestive failure is such a common cause of death in arterial hypertension Possibly the occurrence of fatal strokes and coronary thrombi may be favored by a high arterial pressure although the survey of Sigler does not support the notion that coronary occlusions occur more commonly among hypertensives than among normotensive patients and that the existence of hypertension adversely affects prognosis (147) The largest area of agreement among clinicians concerning attempts to lower the blood pressure includes those with rapidly progressive malignant hypertension and patients suffering from acute complications such as congestive failure, encephalopathy or a recent stroke

In evaluating presumed changes in blood pressure level it must always be kept in mind that occasional readings obtained in the doctor's office may not reflect whether an individual's blood pressure is high or low as he goes about his daily business

CASE 27 *Wide differences in level of blood pressure depending upon patient's reaction to the individual who measures it*

A 26 year old Armenian factory worker provided a graphic example of the difficulty in evaluating blood pressure levels obtained in a physician's office This patient's arterial pressure was invariably elevated when the determination was made by his regular physician, a kindly but rather stern and quick moving individual Even after intravenous injections of Sodium Amytal, with strong reassurance, his arterial pressure remained high, as shown in Figure 33 When, on the other hand, another physician, whom he considered more sympathetic, took the blood pressure it was repeatedly and consistently much lower

There was occasionally observed a 1 1 relation between some symptom and the elevation of blood pressure In such subjects it appeared that inferences could be drawn about the level of blood pressure during ordinary daily activities

CASE 28 *Rarely demonstrated correlation between symptoms and level of blood pressure in a middle aged hypertensive man*

A 53 year old fur cutter complained of attacks of lightheadedness" five months prior to his first visit to the hospital He was found to have hypertension, 160 mm Hg systolic and 100 mm diastolic In Figure 34

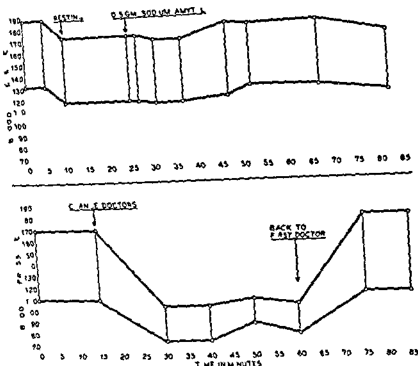


Fig 33 Failure of intravenously administered Sodium Amytal to lower blood pressure while a temporary shift of physicians effected a profound lowering without drugs

are shown the variations in blood pressure recorded in this subject over a period of two years The correlation of high readings with giddiness is clear and hence the presence or absence of giddiness in this patient probably allows of inferences concerning the relative height of the blood pressure

Except in such occasional patients, however the proper evaluation of the course of the blood pressure must await the development of an instrument which will make a record at frequent intervals throughout the day *preferably* without the patient s awareness

A good deal of confusion about the treatment of hypertension has resulted from failure to take into account the knowledge that occasional blood pressure readings may not be repre entative,

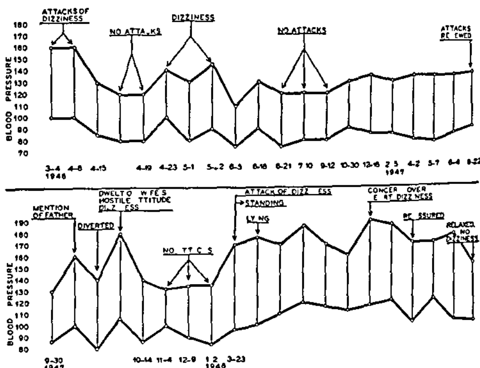


Fig 34 Correlation of level of arterial pressure with the occurrence of attacks of "dizziness" in a 53 year old man

and that the height of the blood pressure, in any case, may reflect poorly the progress of the disease Despite this fact, and the lack of conclusive evidence that lowering the blood pressure per se would be of benefit to this patient, most therapies are directed toward achieving lower blood pressure levels

Drug Therapy

The "antipressor" agents which currently enjoy widest use are 1 hydrazinothalazine hexamethonium and other ganglionic blocking agents and derivatives of veratrum, ergot and rauwolfia The evaluation of these agents is difficult because they have various widespread hemodynamic effects which are incompletely understood, so are the implications of their effects on the health and durability of the human organism as a whole

Excellent recent reviews of the pharmacodynamics of these agents are available (90–92) L hydrazine appears to affect primarily peripheral vascular resistance but it does not appear that

it thereby necessarily reduces cardiac work since tachycardia and increased cardiac output often appear A syndrome similar to lupus erythematosus has also been observed in patients receiving l hydrazine (93) Thus it is likely that subtle effects throughout the body are produced whose potential benefit or hazards will not be discovered for some time

Agents in the veratrum group have a variety of depressor effects on blood pressure mechanisms Usually both cardiac output and peripheral resistance have been found to be decreased as has renal blood flow There is al o evidence of visceral pooling

Hexamethonium and other agents which block autonomic ganglia interfere with adaptive hemodynamic adjustments and also reduce cardiac output by inducing a pooling of blood on the venous ide of the circulatory tree (94 95) They also impede responses of the adrenal medulla and other functions mediated through neural mechanisms whose ramifications have not been fully explored (148)

The ergot derivatives presumably inhibit central sympathetic tone but their antipressor potency in oral dosage has not been impressive Recently in a double blind placebo controlled series Colmore and associates failed to identify any reduction of blood pressure attributable to sublingual administration of one of these agents (96)

The currently popular rauwolfia derivatives interfere with some of the reflex pre sor adjustments but their direct effects on hemodynamic mechanisms are not pronounced Although they may timulate gastric acid secretion (149) and provoke nasal congestion rauwolfia derivatives have a tranquilizing action on the central nervous system which is different from that of barbiturate edatives, (97) but it remains to be seen whether Rauwolfia will prove more u eful than phenobarbital in the management of the hypertensive patient or in interfering with the progress of the di ea e

In Chapter V an account has been given of a lowering of blood pressure with increa e in renal blood flow in association with relaxation and pleasurable fantasies following the intravenous administration of Sodium Amytal Barbiturates exert a reinforcing effect on parasympathetic responses in the hypothalamus and, to

a degree, may inhibit sympathetic reflexes, but this action is minor in comparison to their effect on higher centers, where they possibly inhibit cortical influences over the hypothalamus and in any case produce an effect grossly resembling that of alcohol (43) Both agents induce a general feeling of relaxation and well being unless the patient's attention is focused on unpleasant topics Under these circumstances the individual's reactions are likely to be exaggerated, including the response of the blood pressure

Schroeder, in a recently published book (98), has presented the case for chemotherapy of hypertension He has used agents in various combinations for specific indications, thereby attempting to tap the beneficial properties of each without emphasizing their undesirable effects The difficulties of evaluating chemotherapy in essential hypertension, especially with ambulatory patients, have been pointed up by the study of Shapiro and Grollman in which they found that the lowering of arterial pressure following the administration of hexamethonium and 1 hydralazine in amounts recommended for ambulatory patients was equalled following the administration of placebos (67) The powerful effects which have been observed following placebo administration make it likely that placebo control by the double blind technique is necessary before the pharmacodynamic effects of antipressor drugs can be adequately evaluated

With respect to blood pressure effects, perhaps the most relevant question would be whether or not these antipressor agents blocked the pressor response to stressful life experiences Already on page 100 it has been pointed out that the effects of a stressful interview may break through the established depressor action of hexamethonium bromide Also using the stressful interview as a stimulus Bagwell (99) and associates found that hypertensive subjects showed as great pressor responses to interview while taking 0 25 mg of reserpine four times a day as they showed without the drug

Of course the possibility exists that any of these agents or combinations of them may exert subtle salutary effects on the course of hypertensive cardiovascular disease quite apart from their effects on the blood pressure It is too early to discard any

of them On the other hand it is doubtful that the practicing physician can count on very much benefit to his patients from the routine use of antipressor agents He is bound thereby to induce disagreeable symptoms in many men and women who would otherwise live out a reasonably long life span in comfort His efforts may also cause them undue anxiety and unnecessary financial drain Moreover some patients may develop coronary insufficiency cerebral vascular accidents or further renal damage because of reduced blood flow induced by some of these agents Those in an acute phase with encephalopathy cerebrovascular accident or pulmonary edema may benefit most from drug therapy

Dietary Procedures

The rice diet of Kempner (100) and other dietary regimens in which salt intake is strictly reduced are still widely used at all stages of essential hypertension Although placing a patient with early essential hypertension on the unpalatable low salt diet for a period of months is likely to achieve a lowering of the blood pressure the evidence suggests that the effects of such regimens are temporary at best (101 102)

Such temporary benefits may however have value in the treatment of the malignant phase of essential hypertension There is some evidence that the vascular damage during malignant hypertension can be minimized if the blood pressure can be held at a low level (103 104) Therefore any effective hypotensive measure, including vigorous chemotherapy dietary therapy sympathectomy adrenalectomy or pyrogen therapy might protect the patient's vessels until a remission in the disease occurs In fact Reiser and his associates have observed subsidence of the retinopathy and other manifestations of malignant hypertension during psychotherapy with improvement in the patient's life adjustment (105) Even lobotomy has apparently been responsible for the amelioration of the malignant stage of essential hypertension In Figure 35 is shown the striking improvement in hypertensive retinopathy following lobotomy and psychotherapy in a patient studied by Dr J T Groen of Amsterdam (106)

a degree, may inhibit sympathetic reflexes, but this action is minor in comparison to their effect on higher centers, where they possibly inhibit cortical influences over the hypothalamus and in any case produce an effect grossly resembling that of alcohol (43) Both agents induce a general feeling of relaxation and well being unless the patient's attention is focused on unpleasant topics Under these circumstances the individual's reactions are likely to be exaggerated, including the response of the blood pressure

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reassuring attention of the surgeon himself may also contribute to salutary effects.

The surgical procedure most widely used in this country has been the thoracolumbar sympathectomy devised by Smithwick (107). Although it has been performed on thousands of patients over nearly 20 years, it is still not possible to offer a crisp evaluation of the benefits of the operation (108, 109). One patient described as Case 18 in the present report is of special interest in this connection. There was no reduction in blood pressure following a bilateral thoracolumbar sympathectomy. Six years later, after four years of treatment by interview in the clinic, her blood pressure fell to normal and was thereafter consistently recorded at normal levels for the ensuing two years.

More recently bilateral adrenalectomy has been practiced as a treatment for essential hypertension (110–112). Although it is possible by this means to lower blood pressure in a relatively uniform and predictable way, the need for replacement therapy has obliterated to some extent the hypotensive effects and it is by no means clear that the procedure of adrenalectomy will prove useful (113). The relief of congestive heart failure observed by Jeffers and associates after a four year study of hypertensive patients subjected to adrenalectomy is striking, as is the fact that more than half of their patients who died succumbed to a stroke (114). Currently combined sympathectomy and subtotal adrenalectomy is being tried (150) and a few patients have been subjected to lobotomy (151, 152).

Treatment of the Patient with Respect to His General Life Adjustment

Most of the 114 patients who displayed the usual criteria for essential hypertension in the study were observed over a period of three to seven years or until they died. They were treated primarily by face to face discussions of life experiences, early recollections, attitudes, values and aspirations, and of relationships with parents, family, employers and associates. The characteristics of the individuals are summarized in Chapter VIII and the severity of their disease is shown in Table VI. In the early inter







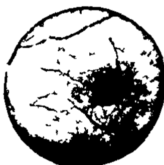


Fig. 35. Photographs of the fundi in Croen's case of malignant hypertension.

Surgical Procedures

Evaluation of the results of surgery in hypertension is subject to the same hazards that apply to other methods of treatment. Not only may the operation itself constitute a major event in the life of the patient but the "build up" of the operation and the

a day when they were having troubles Some exchanged written correspondence with their physician between clinic visits

In many cases other members of the family or even employers were brought in for discussions with the physician always, however, with the knowledge and consent of the patient The social service department frequently helped with attempts to get the various members of a family working together as well as with arranging for employment, convalescent care, care of children while parents were working, etc

Intravenously administered Sodium Amytal was of value in the alleviation of troublesome symptoms, through aiding in the elucidation of dynamic mechanisms and the gaining of therapeutic leverage

Considerable improvement was frequently achieved without the verbal expression of insight Many patients who appeared to have developed some comprehension of the dynamics of their illness were reluctant to express their understanding in words although they often conveyed it indirectly to the physician

Occasionally oral doses of barbiturates were used to give symptomatic relief They were usually employed to tide the patient over a difficult period in his illness and their use was discontinued as soon as possible

The depth or significance of the change effected did not seem to depend so much on the frequency of the interviews or the over all duration of the patient physician relationship as on its quality the effectiveness of the communication and the ability of the patient to use his resources in developing improved patterns of reaction

The most powerful constructive force in therapy seemed to derive from the ability of the physician and the clinic to inculcate in the patient a faith in himself and in his capacity to recognize and deal constructively with his problems This usually involved a reorientation of attitude and entailed far more than a personal attachment to the physician It included an ability on the part of the physician to share the anxieties of the patient without adding to them to tolerate his dissatisfactions and hostilities without

views (which usually occurred at weekly intervals) the main effort was to get to know the patient, to understand his motivations, values, the chief props of his security system and his sensitivities The patient was made to feel welcome and secure in the clinic Without directly saying so the physician tried to make his patient realize that he was in no danger of ridicule, censure or betrayal regardless of his words and actions By taking the patient seriously, together with his interests and preoccupations, the physician tried to enhance his patient's confidence in himself and his feeling of purpose in life

As the patient spoke more and more freely, the physician guided the discussion in such a way as to clarify one after another of the periods or areas of the patient's life Impressions and clues for future interviews were gathered from things said things left unsaid inflections of the voice emphases gestures, slips of the tongue inconsistencies contradictions, non sequiturs, blocks, dreams and associations Throughout this period the physician gave his patient ample opportunity to air his problems and dilemmas but he withheld for the most part any direct advice

The interview situation was as free of ritual as possible Discussions were not necessarily held in the same office each time The length of the interview was not sharply defined Usually it lasted in the neighborhood of an hour but often only 15 minutes and occasionally as long as 2 hours The early interviews were generally longer than the later ones Frequently the very first discussion was surprisingly productive of helpful information Important material might be elicited of which the patient had been previously totally unaware Accordingly the first discussion was usually allowed to go on as long as it was productive

As treatment progressed, not only was the time of each interview shortened somewhat but the interval between interviews was lengthened until eventually some patients were being seen only at intervals of six months

Throughout the period of clinic attendance however the physician maintained himself available for telephone calls Many of the patients phoned several times a week or even more than once

Other more impersonal means of vicariously expressing aggression were encouraged, including sports such as hunting shooting and boxing, involving vigorous or even violent activity

Because of the patient's suspiciousness and sensitivity to symbols of being "pushed around" encouragement and support had to be tendered with great circumspection Gradually however the physician tried to show his patient that tentative efforts at assertive activity in a pertinent direction were safe, and that he could rely on the physician s standing by to lend support during possible crises or feelings of panic

The physician was especially alert to opportunities to assure his patient that the management of anger was within his grasp that he had less need to feel resentful of deprivation rejection, indifference and other threats and that hence he could feel relatively more secure

For a time the patient s security stemmed largely from the crutch that the physician afforded him during his vulnerability Favorable progress of therapy was indicated when the patient s needs became less prominent and his strength and conviction of safety increased

In brief the aims in the management of the hypertensive person in this study became threefold 1) to enable the patient to recognize that he felt threatened and hence angry and anxious 2) to indicate how when he did feel threatened, he might deal with the danger by more direct and appropriate action *rather than* by repression and 3) to help him feel more secure

Results

In all of the 114 subjects transitory changes in the level of the blood pressure were recognized *and correlated* temporally with apparently meaningful events in the life situation It was striking that elevations of blood pressure occurred most characteristically in a setting where a strong conscious or unconscious need to express hostile aggression was blocked by an equally powerful need to placate and keep the peace On the other hand a pronounced fall in blood pressure was often observed following the relatively free expression of aggression or hostility

abandoning him, and by virtue of his own developed personality and stable life orientation to impart confidence that there was a way of life that was both satisfactory and relatively secure

It should perhaps be stated in passing that the physician did not have to allow a consciously or unconsciously erotic relationship to develop with the patient in order to effect a suitable influence The patient, however, had to feel he could completely express his fears and guilt and discuss freely his twisted or confused drives, sexual as well as other It was essential that he feel permitted to divulge fantasies, and it was often necessary for the physician to help him become articulate about an aspect of his behavior which never before had been given voice

Because of the hypertensive patient's tentative and noncommittal ways, the desirability of making commitments was emphasized Efforts were made to show him that there was safety and often satisfaction in such commitments and in the spontaneous exhibition of feelings as they arose

The hypertensive subjects characteristically gave evidence of *hostility in subtle and indirect ways, such as being late for appointments*, misquoting words said at a previous interview denying what had seemed apparent at an earlier visit or complaining that no progress was being made When hostility was altogether unexpressed it took the form of lack of freedom and spontaneity in discussion and laconic replies to questioning The physician attempted to deal with such manifestations by encouraging fuller expression of feelings, taking advantage of every opportunity for the patient to demonstrate to himself that a freer show of aggressive attitudes was safe Such encouragement in the expression of hostile feelings often involved interviews with an associate or another member of the family as mentioned earlier, in order to get the patient properly to appreciate his problems The explanation of the importance of such assertiveness for the patient, especially when the other person interviewed was the target of the aggression, proved to be when sympathetically received, of great importance The physician quietly accepted vicariously directed hostile gestures without retaliation, gently pointing out the connection with past experiences and attitudes of the patient

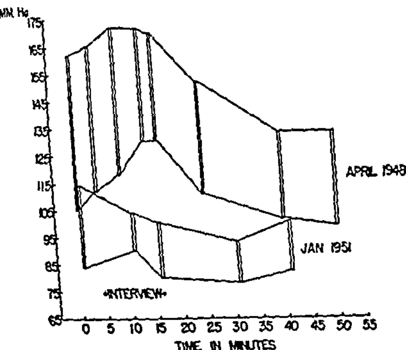


FIG 37 Response of the blood pressure to a stressful interview on two widely separated occasions The patient (Case 1) originally hypertensive appeared to have lost not only his evidences of hypertension following psychotherapy in the clinic but also his proclivity for reacting to stress with a pressor response

years of treatment in the clinic this patient apparently underwent a more fundamental change in attitude than most His change was also manifest in his eating pattern During his hypertensive period he had been a compulsive eater when under stress "If I'm leaving a restaurant after a meal and the cashier doesn't look at me just right it hurts me and I get so mad that I may walk into the restaurant next door and eat another whole meal" After he had lost his evidence of hypertension and although he continued to be markedly obese he no longer felt the need to eat when angry or humiliated He said "Now when I'm upset I lose my appetite and I just can't think of food"

Another patient described in detail as Case 26 after 11 years

CASE 1

For example a purveyor of illicit merchandise already described on page 20 was able to cope with many "tight spots" but not with the contemptuous attitude of his brother in law with whom he was forced to live At age 40, several months after the episode described on page 21, and after another particularly humiliating episode with his brother in law, he came to the laboratory with a blood pressure of 165 mm Hg systolic and 100 mm diastolic The adverse effects of his repressive pattern were pointed out to him and he was encouraged to deal with his problem in a more direct way He promptly left the laboratory and returned an hour later after "beating up" his brother in law At that time his blood pressure was 125/85 He said that he felt relaxed and vindicated Figure 36 illustrates these changes graphically

Ultimately this patient lost his evidence of hypertension altogether and with it his proclivity for reacting to most stressful situations with a pressor response (see Figure 37) During his

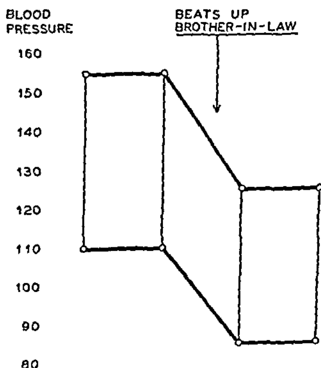


FIG 36 Reduction of arterial pressure in a hypertensive subject (Case 1) following a fairly uninhibited physical expression of aggression

consistently above normal In each, in association with a changed attitude and orientation, the readings became normal and stayed so except for transitory reactions to specific stimuli This change took place without operation and without drugs, but during attendance at clinic

As was pointed out earlier, treatment consisted of encouraging the patient to discuss his life and his problems, and his early relations with his parents siblings and others Unconscious material was elicited from dreams and associations He was allowed to express hostility as freely as he would and the doctor maintained consistently a supporting, friendly attitude Frequently other members of the family were seen and their support enlisted, if possible In Table VIII are summarized pertinent data concerning these 14 individuals

It is significant that except for patient 1 described on pages 20 and 21 these subjects did not lose their tendency to react to situational threats with hypertension but they were apparently able to resort to this reaction only on occasion rather than to adopt it as a way of life as they had formerly done

CASE 29

This tendency is illustrated in Figure 38 by a 50 year old municipal employee who was born into a restrained family with a domineering

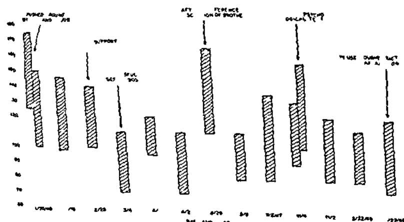


Fig 38 Day to-day variations in blood pressure in a labile hypertensive who ultimately no longer gave evidence of

of known hypertension before she came to the clinic, continued, during two additional years of close observation, to show essentially no change in her blood pressure. Suddenly, however, her *blood pressure fell to near normal manometric readings* on two occasions when she was able to express freely her resentment toward her husband. After two more years, a divorce, and other readjustments as told in the case description, she became normotensive and remained so for two years of further observation.

In all, 14 of the 114 closely followed patients became and have *remained normotensive. All of these individuals initially* displayed the usual evidence of essential hypertension, including blood pressure readings consistently higher than 160/95 and no signs of primary renal disease, endocrine tumor or congenital vascular anomaly. Since, however, as has already been pointed out, we can only know what the level of blood pressure is when it is being measured, it is possible only to say that when we first came in contact with these 14 subjects their blood pressure readings were

TABLE VIII

Fourteen Patients Who Lost Their Evidences of Hypertension

Case #	Sex	Age When Hypertension Discovered	Known Duration of Hypertension in Years	Total Period Of Observation in Years	Duration of Normal BP to last observation in Years
1	M	34	12	7	3
16	M	25	4	4	3
17	M	17	1	5	4
18	F	40	10	6	2
21	M	23	1	7	6
26	F	41	15	6	2
29	M	47	2	8	4
43	M	38	1	6	5
44	M	23	7	6	5
47	M	31	½	5	4
67	F	33	3	6	4
68	M	45	½	4	3
108	M	48	1	3	2
113	M	23	1	2	1

diastolic blood pressures of 35 of 44 patients with hypertension Eight of the group exhibited an elevation in the blood pressure during the period of placebo administration A few patients responded with strikingly lowered levels of the systolic and diastolic pressures which remained low not only during the administration of the placebo but for several weeks thereafter Moreover, many reported a marked reduction in symptoms One patient, known to have had hypertension for 15 years with blood pressure readings as high as 210/135 had an average pressure of 161/97 during the last week of placebo administration Subsequently the pressure remained low and averaged 143/84 when the patient had already been two weeks without ' medication

Throughout the period of study the patients were given words of encouragement and reassurance concerning the efficiency of the substances administered and they were encouraged to discuss their complaints fully It should be clear that not only must caution be exercised in attributing a favorable effect to the pharmacodynamic action of an agent administered but similar caution must attend the appraisal of effects of the patient physician relationship Changes in the patient and his responses may be subject to observation and analysis as in the study reported here but they do not necessarily establish the validity of one or another theory of psychodynamics Neither can the physician safely assume that his emphasis in treatment was the factor chiefly responsible for salutary effects Experience indicates that the same degree of improvement in the patient may be achieved by physicians holding widely divergent views on psychodynamics and using altogether different methods in manipulating the patient physician relationship

SUMMARY

The difficulties in evaluating the therapy of hypertension have been emphasized Although the most widely accepted criterion of success is a sustained lowering of blood pressure there is no proof that prognosis is actually altered thereby In fact there is some evidence notably that of Hoobler which suggests that differences in level of arterial pressure within the hypertensive

mother who never allowed him to express anger He grew up earnest and compliant in contrast to his independent, self reliant older brother who did well in business At 36 he married a school teacher, temperamentally similar to his mother, who emphasized his limitations, made him take speech training and refused to divulge the amount of her salary to him She and his mother did not get on "I was caught between two strong women " Hypertension was first recognized when his job as a meter inspector, which he had held for 28 years, was threatened by a political change

In the clinic he was given strong reassurance and support and was encouraged to express freely his feelings Moreover, long discussions of his recollections and relations to his mother were undertaken His wife was called in and her support was enlisted As he became increasingly relaxed and self confident during treatment, successfully defying his boss at work, he noted that his wife was "softening up " His blood pressure remained normal for the next four years except for brief episodes of elevation associated with specific threats On one occasion his blood pressure rose to 165/110 during discussion of his more successful brother On another occasion a less marked rise in blood pressure occurred following a psychological testing procedure which he felt revealed inadequacies in him

With respect to symptoms, complaints and bodily changes such as giddiness, headache, vertigo, palpitations, dyspnea, muscle pains and aches, constipation and obesity, roughly 40 per cent of the patients improved over the period of study

It is clear from Table VI that those 40 per cent of patients who achieved a lowered blood pressure were not necessarily among the younger group or among those with the shortest duration of known hypertension

Discussion

Although it is clear from this study that many patients felt better after the period of study than before, and a few had lost their evidence of hypertension it is difficult to know whether or not one can attribute the changes to anything that was done by the physicians The favorable effects on blood pressure of the administration of placebo agents has already been dwelt upon Garb (115) was able to achieve a decrease in the systolic and

CHAPTER X

GENERAL SUMMARY AND FORMULATION

A WIDE variety of vasomotor and hemodynamic disturbances in man have been examined from the standpoint of their relation to adverse or threatening life experiences It would appear that cardiovascular functions in general are highly responsive to meaningful events and that a host of arrhythmias and peripheral vascular disorders may arise largely therefrom The various hemodynamic mechanisms have been shown to respond to situations whose force derives from their meaning to the individual in much the same way as they respond to tangible stimuli

The major emphasis in the present study has been on the elusive syndrome called essential hypertension It is recognized at the outset that data bearing on peripheral arterial pressure and pressor mechanisms do not necessarily bear on the processes of vascular degeneration which often accompany sustained elevation of arterial pressure Elevated arterial pressure has been identified in association with several more or less well understood disturbances in the blood vessels glands of internal secretion or kidneys, but by far the most frequent instances of sustained blood pressure elevation have been found to occur in the absence of these structural lesions The common form of hypertension called essential, has been found to be associated in varying degrees with degenerative changes in the arterioles here and there in the body but mainly in the kidneys There is seen however no predictable relationship between these changes and the height of the blood pressure or the duration of hypertension Neither can the course of hypertension nor the likelihood of death from the disease be predicted in the early stages although in general it has been reliably observed that the more labile the blood pressure, the better the prognosis It has also been noted that the most overtly "nerv

range do not correlate with the progress of the disease or the ultimate outcome (65)

Antipressor drugs and surgical operations on various portions of the sympathoadrenal system have not gone far toward solving the problem of therapy in essential hypertension Perhaps the most promising therapeutic approach is toward the patient as a whole and his general life adjustment Even here, however, the results of therapy are only suggestive and it remains to be shown that the pathophysiologic process in essential hypertension can be significantly altered by any currently available measures It is noteworthy that virtually all treatment programs, diverse as they are and usually enthusiastically reported by their proponents have, as a common denominator, a firm cooperative relationship between the patient and his physician

Vigorous muscular exercise is interdicted by most manuals on the therapy of essential hypertension There is little evidence to support the supposed adverse effects of exercise, however, and as illustrated in Chapter II, exercise is a most reliable way to reduce peripheral vascular resistance Moreover, the data presented in the present chapter indicate that relatively uninhibited expressions of aggression, vicarious or otherwise, may be associated with a lowering of arterial pressure Therefore it might be reasonable to suggest prescription rather than proscription of vigorous muscular effort in essential hypertension in those patients whose hearts are well compensated and not enlarged

tension (120) Pickering s review of his own and other recent data attempts a constructive working concept of hypertension and its relationship to vascular disease (121) Most of the data derive from the study of experimental animals rendered hypertensive by a variety of mutilating procedures or by the injection of pressor substances Studies on humans have been made largely in the resting state or during standard maneuvers without reference to the prevailing life situation and emotional state of the individual

Several humoral factors have been demonstrated in the study of experimental and human hypertension There has been much work which would tend to implicate norepinephrine or perhaps both norepinephrine and epinephrine (121) The former produces a hemodynamic pattern similar to that found in human essential hypertension namely, an increase in peripheral resistance without an increase in cardiac output (119) The quantity of epinephrine and norepinephrine excreted in the urine is usually within normal limits in hypertension although in one large series it was found to be greater than normal in about one third of the subjects studied (153) By currently uncertain chemical determination 'resting blood levels of these substances are not higher among hypertensive than among normal individuals but a rise in concentration does occur during acute stress (123) Certainly the action of these agents cannot be ignored on the basis of the fact that increased excretion in the urine is not usually demonstrated The work of several investigators indicates that norepinephrine is manufactured in response to postganglionic sympathetic stimulation in close proximity to the walls of arteries (74 154) Moreover, VEM has been shown to enhance the effects of epinephrine on arterioles (75)

The vaso excitor material (VEM) (125) which increases the sensitivity of the precapillary mesenteric vessels of the rat to the constricting effect of topical epinephrine was first demonstrated in the blood of animals with acute experimental renal hypertension It was apparently a peptide produced by normal kidneys under anoxic conditions and by the oxygenated kidneys of hypertensive patients and animals Its increased concentration in the blood during chronic experimental renal or human essential hypertension is balanced by the increased amounts of another sub

ous" patients, who become red faced during excitement and whose blood pressure falls to normal during sleep, seem to follow the most benign course (116, 122)

After more than 50 years of study with mechanical, chemical and electrical tools, the elucidation of mechanisms involved in *essential hypertension is still incomplete Although there are a* good many known physiologic and pathologic processes which are capable of producing hypertension, none of them has been shown to fit precisely the process we recognize as essential hypertension

Essential hypertension is mainly a diagnosis of exclusion, made by most clinicians on the basis of sphygmomanometric data re peatedly recorded but with or without any recognizable arteriolar *lesions The cardiac output is normal Systemic peripheral re* sistance is increased while pulmonary peripheral resistance is normal Blood flow to most organ systems is normal Blood flow to the kidneys however, is usually reduced, although glomerular filtration remains normal The blood volume, hematocrit, and vis cosity are normal In the present communication reversible altera tion of most of these functions has been recorded during the stress *of meaningful events in the day to day lives of the subjects*

Early in the disease, essential hypertension changes occur in capillary structure, and the precapillary sphincters show an in creased sensitivity to topical or systemically administered epineph rine and norepinephrine (117–119) Minor structural changes of the same type have been observed in some normotensive subjects and in subjects with hyperglobulinemia and hepatic cirrhosis

Biomicroscopy of the minute circulation has been too recently applied to the problem, and available therapy is too ineffective to permit judgement as to the reversibility of the structural changes In the few subjects observed, however, the changes noted have persisted despite return of the blood pressure to normal *(117)*

One must continually bear in mind that although the blood pressure is the sign whereby hypertensive disease is identified its importance in the ultimate development of vascular lesions is not known It was early demonstrated that pressor responses could be produced by interfering with the reflex activity arising from receptors in the carotid sinus and arch of the aorta Sub sequent *studies have not supported the possibility that these*

has been demonstrated in the peripheral blood of patients with acute toxemia of pregnancy and acute glomerulonephritis whose blood pressure was rising rapidly (128), and in animals with acute experimental renal hypertension Neither renin nor any of the other pressor substances which have grown out of studies of animals rendered hypertensive by a variety of experimental methods are regularly found in human hypertension When found, they do not correlate well with the course or type of hypertension and especially do not seem to be implicated in the malignant phase

Some of the discrepancies may be related to the evidence from animal experimentation that not only is the kidney capable of secreting substances which raise the blood pressure but it normally exerts a lowering effect on blood pressure This function may be impaired in chronic experimental renal hypertension (129 130) and conceivably in essential hypertension in man

The pituitary adrenocortical axis has been implicated by many investigators who have shown that it is possible to manipulate the blood pressure by injecting corticotrophin or corticoids and possible to lower the pressure by removal of the adrenals

The participation of the adrenal cortex in stress reactions has been copiously documented but incompletely studied in man Whether connected with the adrenal or not major alterations of water and electrolyte excretion have been recorded in response to situational stress associated with marked abrupt changes in weight in both hypertensive and normotensive subjects (131) The extracellular fluid volume of hypertensive individuals as a group is slightly increased (132) as is their tolerance to salt deprivation Actual salt restriction is capable of lowering blood pressure in humans and in experimental animals excessive salt intake seems to potentiate the vascular damage produced by injections of renin or desoxycorticosterone (133–135) The blood pressure of patients with essential hypertension rises more readily after administration of desoxycorticosterone than does that of most normotensive subjects although some normotensive subjects may show these same characteristics (136) No consistent abnormality of adrenal cortical secretion or structure has been demonstrated in human essential hypertension but excessive secretion of antidiuretic hormone by the neurohypophysis does apparently occur (139) Also in man temporary increase in systolic and diastolic pressure has been

stance known as VDM and identified as ferritin This material, *which is of hepatic origin*, decreases the sensitivity of vessels to epinephrine Both VEM and VDM, being present in the blood in increased amounts in essential hypertension, largely cancel each other out in the bioassay, which is at best inexact (126) When, in a procedure quite similar to the bioassay, epinephrine is applied to the human bulbar *conjunctiva, the sensitivity to epinephrine* of the minute vessels of hypertensive subjects is definitely greater *than that of controls (117)* Moreover, the staining characteristics of kidneys capable of producing VEM aerobically (experimental or human hypertension) are altered in a characteristic way Whether or not these changes occur as a sequel to prolonged neurogenic renal vasoconstriction is not known, but they do not *appear to be reversed by sympathectomy*

Some aliphatic amines (as differentiated from phenolic amines such as epinephrine and norephinephrine) have been found to have a pressor action when injected into experimental animals One of this group, named pherentasin has been demonstrated in the arterial blood of a high proportion of hypertensive patients (124), and in a minority of normotensive subjects Since it may be present or absent at different times in the same hypertensive subject, there is a need to study its concentration in relation to stress

It is possible that vasoactive substances other than epinephrine, norepinephrine and neurohypophyseal hormones are liberated by nervous tissue

The search for humoral pressor mechanisms in essential hypertension has received impetus from the frequent occurrence of hypertension as a complication of primary renal disease and from *studies on experimental renal hypertension in animals (127)*

Renin a proteolytic enzyme is present in relatively large concentrations in the renal cortex of animals, *including humans* Acted upon by renin, hypertensinogen a substrate substance produced by the liver and present in the blood as an alpha 2 globulin, is converted into a polypeptide known as hypertensin or angiotonin This substance can be demonstrated by its vasoconstrictor effect in experimental animals Renin, in smaller concentrations, can be demonstrated by permitting it to act *in vitro* upon added hypertensinogen, and assaying the resulting hypertensin Renin

The well established observation that essential hypertension often "runs in families" has led to emphasis by some workers on an hereditary factor. Since one may inherit attitudes, patterns of behavior and ways of looking at life, as well as bodily organs, it is difficult to distinguish between genetic effects and influences which derive from contact with the family.

Several investigators of isolated societies and relatively homogeneous ethnic groups have shown striking deviations from the expected incidence of essential hypertension in 20th century Western civilization. These studies have been variously interpreted as indicating dietary (cholesterol or calories), genetic, or sociocultural factors in the etiology of essential hypertension. Unfortunately it has not been possible to delineate clearly among them or to separate out any one for individual consideration. Moreover it becomes increasingly apparent that diet is often an important symbol of social status.

One of the most interesting long term studies concerned with susceptibility to hypertension is that of Thomas and her associates who found among normotensive subjects with a prominent family history of hypertension (137) the varieties of vascular reactivity and response to salt restriction characteristic of hypertensives.

Granting the probability of a stock bound proclivity which may be aggravated by overeating, life stress is the only etiologic factor which has continued to provide investigators, over the 50 years of study, evidence of its pertinence to the pathogenic process in essential hypertension. Not only may the hemodynamic changes characteristic of hypertension, including a reduction in renal blood flow, be induced for short periods in suitably susceptible persons by the contemplation of stressful life experiences, but long term variations in blood pressure level have been repeatedly correlated with periods of stress. Moreover, the data indicate that the course of essential hypertension may be mitigated by measures directed at enhancing the satisfactions and improving the adjustment of the individual.

Very few years after the sphygmomanometer became available in this country, Moschcowitz observed the similarity between the symptoms of essential hypertension and those of *neurosis*. He also noted that the symptoms bear little relationship to the height of the blood pressure and he described a characteristic pattern of

produced during brain operations by electrical stimulation of the posterior orbital surface of the frontal lobes and of the tips of the temporal lobes (140)

Finally, it has been tacitly assumed by many that the sympathetic nerves are in some way involved *in the pathogenesis of* essential hypertension, particularly in the early phase Nevertheless, the evidence in favor of disturbances in the sympathetic system is not very convincing Sympathetic impulses are activated by changes in posture, and yet blood pressure variations associated with posture changes are not a feature of essential hypertension until the sympathetic chain has been removed Furthermore, numerous authors have shown that peripheral vasoconstriction may persist in hypertensive patients despite removal of the sympathetic chains, and in the experiments quoted in this volume it has been shown that short term pressor responses to stressful *interviews are just as readily produced in patients without the* sympathetic innervation as in the intact individual Thus, the mechanisms responsible for pressor responses to difficult life situations have as yet to be demonstrated They do not depend entirely and may not depend very heavily on the presence of the thoracolumbar sympathetic nerves and ganglia

In short, the pressor mechanisms involved in essential hypertension are still obscure, although a great many ways have been brought to light whereby blood pressure may be modified

The physiological alterations occurring in essential hypertension are numerous, complex and closely interrelated It is characteristic *of the disorder itself that arterial pressure is elevated in the* systemic circulation but not in the pulmonary circuit Most of the humoral agents which have been thought to be implicated in the production of essential hypertension induce *hypertension in* both the systemic and pulmonary beds An exception is pitressin which has been shown by Nelson et al to produce systemic arterial hypertension without pulmonary hypertension (155) The same workers have shown that situational stresses also induce systemic hypertension without pulmonary arteriolar constriction As suggested earlier it may be *that the initial adjustments provoke renal* ischemia which may in turn set off a variety of endocrine and *other humoral* mechanisms with the ultimate development of irreversible tissue damage

The well established observation that essential hypertension often 'runs in families" has led to emphasis by some workers on an hereditary factor Since one may inherit attitudes, patterns of behavior and ways of looking at life, as well as bodily organs, it is difficult to distinguish between genetic effects and influences which derive from contact with the family

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personality adjustment which he found repeatedly among his hypertensive patients (156)

The life histories, attitudes and reactions of the hypertensive subjects of our study yielded an impression of homogeneity not amounting to a uniform personality pattern Rather there was seen among these individuals a clustering of certain attitudes and values on the one hand and of certain sensitivities and vulnerabilities on the other Hypertensive subjects were not set apart by a uniform personality profile, or characteristic set of emotional conflicts, or by a special pattern of behavior, but there did appear to be a striking similarity in the way they looked at life, the way they evaluated events, problems and challenges, and the manner in which they dealt with them They were inclined to be tentative and wary, fundamentally driving and often hostile but not able fully to commit or assert themselves These attitudes, of course, are neither unique nor exclusive to individuals with essential hypertension, but it can be said that they are seen frequently enough to be familiar They have been recognized and described with slightly different words by several workers There has even been a statistical validation of the characteristic difficulty which hypertensive subjects have with self assertion (86)

The elusive nature of the natural history of hypertension has made the evaluation of therapy as difficult as is the identification of factors in cause and mechanism Drugs, diets surgical and psychotherapeutic procedures have been variously recommended and thought to be 'successful' in a limited way Many patients and physicians, however prefer to ignore the condition in its benign state and one author wrote ' the kindest thing to do when one discovers a patient with hypertension but no symptoms is to keep the information to oneself ' (157)

The question whether or not to allow hypertensive patients to engage in vigorous muscular exertion is usually decided in the negative although as pointed out earlier the evidence favors free indulgence in exercise as a reliable way to reduce peripheral vascular resistance and often to lower pressure The authors have begun to recommend regular vigorous exercise to hypertensive patients whose hearts are not enlarged or decompensated

In all studies of the natural history of hypertension a small percentage of patients after months or years 'spontaneously lose

their evidence of elevated arterial pressure This does not always indicate improvement in the disease A fall to normal blood pressure often occurs following a stroke or coronary occlusion and furthermore progression of arteriolar changes including papilledema has been reported in the presence of normal arterial pressure (138) The present study suggests but by no means demonstrates that improvement or remission in essential hypertension may be achieved if the individual can be made to feel more secure Freer and more fearless self assertion brought about by a variety of devices has been associated among our subjects with a short or long lasting lowering of arterial pressure Whether this specifically leads to therapeutic benefits over and above those achieved by a satisfactory and sustained doctor patient relationship is still uncertain As pointed out earlier a rapport between a patient and his physician which gives the patient understanding and encouragement is a factor common to all current therapeutic regimens as superficially diverse as salt restriction and sympathectomy Unfortunately uncooperative or unimpressed patients who would not carry through with the therapeutic procedure have often been used as controls in reported series Since in such studies neither the supportive relationship with the doctor nor the therapeutic procedure being tested were operative among control subjects it is difficult to distinguish the effects of these two factors in the treated groups Twelve per cent of the patients in this report reverted to and maintained normal blood pressure for months or years Whether this finding reflects merely a phase in the natural history of hypertension or represents a real therapeutic effect is still not altogether clear From the experiences related here however it is justified to suggest a widespread trial of therapy directed toward encouraging patients to a freer and more fearless self assertion and a capacity to make wholehearted commitments The results of such studies will of course continue to be difficult to evaluate until ways of appraising the seriousness and predicting the course of essential hypertension are worked out With all these limitations in mind there is evidence enough to warrant the clinician s taking a serious interest in the background, life experience and attitudes of his patient in the hope of helping him to a more constructive adjustment

BIBLIOGRAPHY

1 SMITH, H W Physiology of the renal circulation Harvey Lect, Series 35 166, 1939–40

2 DI PALMA, J R, REYNOLDS, S R M, AND FOSTER F I Quantitative measurement of reactive hyperemia in human skin Am Heart J, 23 377, 1942

3 T'ANG, H Y, AND WANG, S H Clinical application of plasma viscosity determination description of pipette viscosimeter and the report of findings in tuberculosis Chinese M J, 57 546, 1940

4 HICKAM, J B, CARGILL, W H AND GOLDEN A Cardiovascular reactions to emotional stimuli Effect on the cardiac output, arteriovenous oxygen difference arterial pressure and peripheral resistance J Clin Investigation 27 290 1948

5 STEVENSON, I P, DUNCAN, C H, AND RIPLEY, H S Variations in the electrocardiogram with changes in emotional state Geriatrics, 6 164, 1951

6 WOLF, S, AND WOLFF H G *Human Gastric Function an Experimental Study of a Man and His Stomach* 2nd edition Oxford University Press, New York, 1947

7 MASTER, A M, AND OPPENHEIMER, E T A simple exercise tolerance test for circulatory efficiency with standard tables for normal individuals Am J M Sc 177 223, 1929

8 REISER, M F, FERRIS, E B AND LEVINE, M Cardiovascular Disorders, Heart Disease and Hypertension *Recent Developments in Psychosomatic Medicine* edited by WITTKOWER AND CLEGHORN Pitman, London 1954

9 MASTER, A M, FRIEDMAN R, AND DACK, S The electrocardiogram after standard exercise as a functional test of the heart Am Heart J 24 777, 1942

10 DUNCAN, C H STEVENSON I P AND RIPLEY H S Life situations, emotions and paroxysmal auricular arrhythmias Psychosom Med 12 23 1950

11 STEVENSON, I P, DUNCAN C H, WOLF S RIPLEY, H S AND

WOLFF, H G Life situations emotions and extrasystoles Psychosom Med, 11 257, 1949

12 ALTSCHULE M D The relation between vagal activity and auricular fibrillation in various clinical conditions New England J Med 233 265 1945

13 HARVEY W P AND LEVINE S A Paroxysmal ventricular tachycardia due to emotion possible mechanism of death from fright J A.M.A. 150 479, 1952

14 WOLF S AND WOLFF H G *Headaches Their Nature and Treatment* Little Brown & Co Boston 1953

15 MITTELMANN B AND WOLFF, H G Affective states and skin temperature Experimental study of subjects with cold hands and Raynaud s syndrome Psychosom Med, 1 271 1939

16 BEY E B Isolated arterial spasm Tr A Am Physicians 1954 In press

17 GRAHAM D T AND WOLF S The Pathogenesis of urticaria Experimental study of life situations emotions and cutaneous vascular reactions J A M A 143 1396 1950 Also Proc A Res Nerv & Ment Dis 29 987 1950

18 PONDER E The Capillaries and the Lymphatics *Howell s Text book of Physiology* edited by JOHN FULTON 15th edition W B Saunders & Co Philadelphia and London, 1949

19 HARDY J D AND SODERSTROM G F An improved apparatus for measuring surface and body temperature Rev Scient Instruments 8 419 1937

20 BILISOLY F N GOODELL H AND WOLFF H G Vasodilatation lowered pain threshold and increased tissue vulnerability Arch Int Med 94 759 1954

21 DUNBAR F *Emotions and bodily changes A Survey Of Literature On Psychosomatic Interrelationships 1910–1945* Columbia University Press New York 1954

22 GRANT R T PEARSON R S B AND COMEAU W J Observations on urticaria provoked by emotion by exercise and by warming the body Clin Sc 2 253 1936

23 HOPKINS J G KESTEN B M AND HAZEL O G Urticaria provoked by heat or by psychic stimuli Arch Dermat & Syph 38 679 1938

24 SAUL L J AND BERSTEIN C JR The emotional settings of some attacks of urticaria Psychosom Med 3 349 1941

25 STOKES, J H, KULCHAR, G V, AND PILLSBURY, D M Effect on the skin of emotional and nervous states Etiologic background of urticaria with special reference to psychoneurogenous factor Arch Dermat & Syph, 31 470, 1935
26 LEWIS, T *The Blood Vessels of the Human Skin and Their Responses* Shaw and Sons, Ltd, London, 1927
27 GRAHAM, D T, AND WOLF, S The relation of eczema to attitudes and to vascular reactions of the human skin J Lab & Clin Med, 42 238 1953
28 DOIG R, AND WOLF, S Unpublished observations
29 GRACE, W J, WOLF, S, AND WOLFF, H G *The Human Colon* Paul Hoeber, New York, 1951
30 DUNNING, H S Intracranial and extracranial vascular accidents in migraine Arch Neurol & Psychol 48 396 1942
31 SEIDENBERG, R, AND ECKER, A Psychodynamic and arteriographic studies of acute cerebrovascular disorders Psychosom Med, 16 374 1954
32 PERERA, G A The natural history of hypertensive vascular disease *Hypertension*, p 363 edited by E T BELL University of Minnesota Press, Minneapolis, 1951
33 FREIS E D The treatment of hypertension with particular reference to the use of hypotensive drugs Bull Georgetown Univ M Center, 7 2, 1953
34 McDOWELL F H, AND PLUM F Arterial hypertension associated with acute anterior poliomyelitis New England J Med 245 241, 1951
35 RUSKIN A BEARD, O W AND SCHAFFER R L 'Blast hypertension' Elevated arterial pressures in the victims of the Texas City Disaster Am J Med 4 228 1948
36 RUSKIN A, AND BEARD, O W The Texas City disaster Cardiovascular studies, with follow up results Texas Rep Biol & Med 6 234, 1948
37 SIMONS, D J DAY E, GOODELL HELEN, AND WOLFF H G Experimental studies on headache muscles of the scalp and neck as sources of pain Proc A Res Nerv & Ment Dis 23 228, 1943
38 WOLFF H G *Headache and Other Head Pain* Oxford University Press, New York 1948
39 WOLFF, H G TUNIS M M, AND GOODELL H Studies on headache evidence of tissue damage and changes in pain sensitivity

in subjects with vascular headaches of the migraine type Arch Int Med, 92 478, 1953
40 Moorman, I J Personal communication
41 O Hare J P Vascular reactions in vascular hypertension Am J M Sc 159 369 1920
42 Schneider R A Unpublished data
43 Wolf S and Ripley H S Studies on the action of intravenously administered Sodium Amytal Am J M S 215 56, 1948
44 Starr I Rawson A J Schroeder H A and Joseph N R Studies on the estimation of cardiac output in man and of abnormalities in cardiac function from the heart s recoil and the blood s impact the ballistocardiograph Am J Physiol 127 1 1939
45 Starr I and Rawson A J The vertical ballistocardiograph, changes in the cardiac output on assuming the erect posture, with a further theoretical study of the blood s impacts Am J Physiol 133 461 1941
46 Starr I, Horwitz O Mayock R I and Krumbhaar E B Standardization of the ballistocardiogram by simulation of the heart s function at necropsy, with a clinical method for the estimation of cardiac strength and normal standards for it Circulation 1 1073 1950
47 Gordon J W On certain molar movements of the human body by the circulation of the blood J Anat & Phy iol 11 533 1877
48 Henderson Y The mass movements of the circulation as shown by a recoil curve Am J Physiol 14 287 1905
49 Starr I and Schnabel T G Jr Studies made by simulating systole at necropsy III On the genesis of the systolic waves of the ballistocardiogram J Clin Investigation 33 10 1954
50 Cournand A Ranges H A and Riley R L Comparison of results of the normal ballistocardiogram and a direct Fick method in measuring the cardiac output in man J Clin Investigation 21 287 1942
Cournand A Riley R I Bradley S E, Breed E S Noble, R P Lauson H S Gregersen M I and Richards D W Studies of the circulation in clinical shock Surgery 13 964 1943
51 Nickerson J I and Curtis H J The design of the ballistocardiograph Am J Physiol 142 1 1944

52 NICKERSON, J L The low frequency, critically damped ballistocardiograph Federation Proc, 4 201, 1945
53 NICKERSON, J L, WARREN, J V, AND BRANNON, E S The cardiac output in man studies with the low frequency, critically damped ballistocardiograph and the method of right atrial catheterization J Clin Investigation, 26 1, 1947
54 CATHCART, R T, FIELD, W W, AND RICHARDS, D W, JR Comparison of cardiac output determined by the ballistocardiograph (Nickerson apparatus) and by the direct Fick method J Clin Investigation, 32 5, 1953
55 CARDON, P V, JR, AND LUKAS, D S Changes in cardiac output during the cold pressor test Comparison of low frequency ballistocardiograph and direct Fick methods J Clin Investigation, 32 559, 1953
56 RICHARDS, D W Personal communication
57 DOCK, W, AND TAUBMAN, F Some technics for recording the ballistocardiogram directly from the body Am J Med, 7 751, 1949
58 FUNKENSTEIN, D H, KING, S H, AND DROLETTE, M The direction of anger during a laboratory stress inducing situation Psychosom Med 16 404, 1954
59 DUNCAN, C H STEVENSON I P, AND WOLFF, H G Life situations, emotions and exercise tolerance Psychosom Med 13 36, 1951
60 STEVENSON, I P, DUNCAN, C H, FLYNN J T, AND WOLF S Hypertension as a reaction pattern to stress Correlation of circulatory hemodynamics with changes in the attitude and emotional state Am J M Sc 224 286, 1952
61 WOLF, G A, JR, AND WOLFF, H G Studies on the nature of certain symptoms associated with cardiovascular disorders *Psychosom Med 8 293 1946*
62 PALMER R S, LOOFBOUROW D AND DOERING, C R Prognosis in essential hypertension eight year follow up study of 430 patients on conventional medical treatment New England J Med, 239 990 1948
63 WOLF, S, PFEIFFER J B, RIPLEY, H S, WINTER O S AND WOLFF, H G Hypertension as a reaction pattern to stress summary of experimental data on variations in blood pressure and renal blood flow Ann Int Med 29 1056, 1948
64 GOLDRING, W, AND CHASIS, H *Hypertension and Hypertensive Disease* The Commonwealth Fund, New York 1944

65 Hoobler S W Discussion *Hypertension* p 371, edited by E T Bell University of Minnesota Press Minneapolis 1951
Griep A H Barry, G R, Wall W C and Hoobler S W The prognosis in arterial hypertension Report of 117 patients under 53 years of age followed for 8 to 10 years. Am J M Sc, 221 239 1951
66 Wilkins R W Discussion *Hypertension*, p 323 edited by E T Bell University of Minnesota Press Minneapolis 1951
67 Shapiro A P and Grollman, A A critical evaluation of the hypotensive action of hydrallazine, hexamethonium tetraethyl ammonium and dibenzyline salts in human and experimental hypertension Circulation 8 188 1953
68 Lamport H Formulae for afferent and efferent arteriolar resistance in the human kidney an application of the effects of spinal anesthesia J Clin Investigation, 20 535 1941
69 Gomez D M Calculation of effective afferent and efferent renal resistance Federation Proc 7 41 1948
70 Schneider R A The relation of stress to clotting time relative viscosity and certain other biophysical alterations of the blood in the normotensive and hypertensive subject Proc A Res Nerv & Ment Dis, 29 818 1950
71 Margulies H and Barker N W The coagulation time of blood in silicone tubes in patients receiving Dicumarol Am J M Sc 218 52 1949
72 Wolf S and Hardy J D Studies on pain Observations on pain due to local cooling and on factors involved in the cold pressor effect Proc A Res Nerv & Ment Dis 23 123 1943
73 Cannon W B and Mendenhall W I Factors affecting the coagulation time of blood Am J Physiol, 34 225, 1914
74 Bacq Z M and Fischer P Nature de la substance sympathicomimetique extraite des nerfs ou des tissues mannifers Arch Internat de Physiol 55 73 1947
75 Shorr E Zweifach B W Furchgott, R F and Baez, S Hepatorenal factors in experimental hypertension In *Transactions of the First Conference in Factors Regulating Blood Pressure* Josiah Macy Jr Foundation New York 1947
76 Wolff H G and Wolf S The management of hypertensive patients *Hypertension* pp 457–489 edited by E T Bell University of Minnesota Press Minneapolis 1951
77 Sheldon W H Personal communication

78 HOLMES, T H, GOODELL, H, WOLF, S, AND WOLFF, H G *The Nose An Experimental Study of Reaction Within the Nose in Human Subjects During Varying Life Experiences* Charles C Thomas, Springfield, Ill, 1950
79 FRIEDMAN, M, AND KASANIN, J S Hypertension in only one of identical twins report of a case, with consideration of psychosomatic factors Arch Int Med, 72 767, 1943
80 FLYNN, J T, KENNEDY, M A K, AND WOLF, S Essential hypertension in one of identical twins an experimental study of cardiovascular reactions in the Y twins *Proc A Res Nerv & Ment Dis*, 29 954, 1950
81 SHELDON, W H, AND BALL, R Physical characteristics of the Y twins and their relation to hypertension Proc A Res Nerv & Ment Dis, *29* 962, 1950
82 BINGER, C A L, ACKERMAN, N W, COHN, A E, SCHROEDER, H A, AND STEELE, J M Personality in arterial hypertension Monograph No 8 Psychosom Med 1945
83 WEISS, E Psychosomatic aspects of hypertension J A M A 120 1081, 1942
84 ALEXANDER, F Emotional factors in essential hypertension Psychosom Med, 1 173, 1939
85 SAUL L J Hostility in cases of essential hypertension Psychosom Med, 1 153, 1939
86 SASLOW, G GRESSEL, G C, SHOBE F O, DUBOIS P H AND SCHROEDER, H A Possible etiologic relevance of personality factors in arterial hypertension Psychosom Med 12 292 1950
87 HARRIS R E, SOKOLOW, M, CARPENTER L G JR, FREEDMAN M HUNT S P Response to psychologic stress in persons who are potentially hypertensive Circulation 7 874 1953
88 PERERA G A Hypertensive vascular disease, description and natural history J Chronic Dis 1 33, 1955
89 ECKER, A Emotional stress before strokes A preliminary report of 20 cases Ann Int Med 40 49 1954
90 HOOBLER S W, AND DONTAS, A S Drug treatment of hypertension Pharmacological Rev 5 135 1953
91 GREEN, H D Pharmacology of antihypertensive drugs Am J Med, 17 70 1954
92 FREIS, E D ROSE, J C HIGGINS T F, FINNERTY F A JR., KELLEY R T, AND PARTENOPE E A The hemodynamic effects of hypertensive drugs in man I hydrazinophthalazine Circulation 8 199 1953

93 PERRY, H M JR, AND SCHROEDER H A Syndrome simulating collagen disease caused by hydralazine (Apresoline) J.A M A 154 670 1954

94 GROB D SCARBOROUGH W R KATTUS A A JR. AND LANGFORD, H G Further observations on the effects of autonomic blocking agents in patients with hypertension (hexamethonium and pentamethonium) Circulation, 8 352 1953

95 CORNSKY B PREEDY J R K WHEELER H O HAYS, R M AND BRADLEY S E Splanchnic pooling' during the hypotensive action of hexamethonium bromide in the dog J Clin Investigation 33 924 1954

96 COLMORE JOHN P Unpublished data

97 SCHNEIDER R A AND WOLF S Unpublished data

98 SCHROEDER H A Hypertensive Diseases Cause and Control Philadelphia Lea & Febiger 1953

99 BAGWELL K DYCUS D L AND WOLF S Unpublished data

100 KEMPNER W Treatment of kidney disease and hypertensive vascular disease with rice diet North Carolina M J 5 125 1944

101 LOOFBOUROW D C CALLAHAN D, AND PALMER R S The rice diet in ambulatory patients with essential hypertension A two-year study of 105 patients New England J Med 244 577 1951

102 CHAPMAN C B Some effects of the rice fruit diet on patients with essential hypertension *Hypertension*, pp 504–516 edited by E T BELL University of Minnesota Press Minneapolis 1951

103 SMITHWICK R H Discussion *Hypertension* p 534, edited by E T BELL University of Minnesota Press Minneapolis 1951

104 PAGE I H TAYLOR R D AND CORCORAN A C Pyrogens in the treatment of malignant hypertension *Hypertension* pp 524–533 edited by E T BELL University of Minnesota Press Minneapolis 1951

105 REISER M F BRUST A A AND FERRIS E B JR Life situations emotions and the course of patients with arterial hypertension Psychosom Med 13 133 1951

106 GROEN J Prefrontal lobotomy and psychotherapy of malignant hypertension case Nederl tydschr geneesk 95 236 1951

107 SMITHWICK R H Surgery of the autonomic nervous system In Cole s Operative *Technic in Specialty Surgery* Vol. 2 pp 553–598 Appleton Century Crofts New York 1949

108 SMITHWICK R H The effect of sympathectomy upon the mortality and survival rates of patients with hypertensive cardiovascular

78 HOLMES, T H, GOODELL, H, WOLF, S, AND WOLFF, H G *The Nose An Experimental Study of Reaction Within the Nose in Human Subjects During Varying Life Experiences* Charles C Thomas, Springfield, Ill, 1950

79 FRIEDMAN, M, AND KASANIN, J S Hypertension in only one of identical twins report of a case, with consideration of psycho somatic factors Arch Int Med, 72 767, 1943

80 FLYNN, J T, KENNEDY, M A K, AND WOLF, S Essential hyper tension in one of identical twins an experimental study of cardiovascular reactions in the Y twins Proc A Res Nerv & Ment Dis, 29 954, 1950

81 SHELDON, W H, AND BALL, R Physical characteristics of the Y twins and their relation to hypertension Proc A Res Nerv & Ment Dis, 29 962, 1950

82 BINGER, C A L, ACKERMAN, N W, COHN, A E, SCHROEDER H A, AND STEELE J M Personality in arterial hypertension Monograph No 8 Psychosom Med, 1945

83 WEISS, E Psychosomatic aspects of hypertension J A M A, 120 1081, 1942

84 ALEXANDER F Emotional factors in essential hypertension *Psychosom Med, 1 173, 1939*

85 SAUL L J Hostility in cases of essential hypertension Psychosom Med, 1 153 1939

86 SASLOW, G GRESSEL, G C, SHOBE, F O DUBOIS, P H, AND SCHROEDER, H A Possible etiologic relevance of personality factors in arterial hypertension Psychosom Med, 12 292, 1950

87 HARRIS R E, SOKOLOW M, CARPENTER, L G, JR, FREEDMAN M, HUNT S P Response to psychologic stress in persons who are potentially hypertensive Circulation 7 874 1953

88 PERERA, G A Hypertensive vascular disease description and natural history *J Chronic Dis, 1 33 1955*

89 ECKER A Emotional stress before strokes A preliminary report of 20 cases Ann Int Med 40 49, 1954

90 HOOBLER, S W, AND DONTAS A S Drug treatment of hyper tension *Pharmacological Rev, 5 135 1953*

91 GREEN, H D Pharmacology of antihypertensive drugs Am J Med 17 70, 1954

92 FREIS, E D, ROSE J C HIGGINS T F FINNERTY, F A, JR. KELLEY R T, AND PARTENOPE, E A The hemodynamic effects of hypertensive drugs in man I hydrazinophthalazine Circulation 8 199 1953

93 Perry H M Jr and Schroeder, H A Syndrome simulating collagen disease caused by hydralazine (Apresoline) J A M.A, 154 670, 1954

94 Grob D Scarborough W R Kattus A A Jr and Langford H G Further observations on the effects of autonomic blocking agents in patients with hypertension (hexamethonium and pentamethonium) Circulation, 8 352, 1953

95 Cohn sky B Pfledy J R K, Wheeler H O, Hays, R M, and Bradley S E Splanchnic pooling' during the hypotensive action of hexamethonium bromide in the dog J Clin Investigation 33 924, 1954

96 Colmore John P Unpublished data

97 Schneider, R A and Wolf S Unpublished data

98 Schroeder H A Hypertensive Diseases Cause and Control Philadelphia Lea & Febiger, 1953

99 Bagwell, K Dacus D L and Wolf S Unpublished data

100 Kempner W Treatment of kidney disease and hypertensive vascular disea e with rice diet North Carolina M J 5 125 1944

101 Loofbourow, D C Callahan D and Palmer R S The rice diet in ambulatory patients with essential hypertension A two-year study of 105 patients New England J Med 244 577 1951

102 Chapman C B Some effects of the rice fruit diet on patients with essential hypertension *Hypertension* pp 504-516 edited by E T Bell University of Minnesota Press Minneapolis 1951

103 Smithwick, R H Discussion *Hypertension* p 534 edited by E T Bell University of Minnesota Press Minneapolis 1951

104 Page I H Taylor R D, and Corcoran A C Pyrogens in the treatment of malignant hypertension *Hypertension* pp 524-533 edited by E T Bell University of Minnesota Press Minneapolis 1951

105 Peiser, M F Brust A A, and Ferris E B, Jr Life situations emotions and the course of patients with arterial hypertension Psychosom Med 13 133 1951

106 Groen J *Prefrontal* lobotomy and psychotherapy of malignant hypertension case Nederl tydschr geneesk 95 236 1951

107 Smithwick R H Surgery of the autonomic nervous system In Cole's *Operative Technic in Specialty Surgery* Vol 2 pp 553-598 Appleton Century Crofts New York 1949

108 Smithwick R H The effect of sympathectomy upon the mortality and survival rates of patients with hypertensive cardiovascular

disease *Hypertension*, p 429, edited by E T BELL University of Minnesota Press, Minneapolis, 1951

109 PLATT, R, AND STANBURY, S W Sympathectomy in hypertension Lancet, 1 651, 1950

110 GREEN, D M, NELSON, J N, DODDS, G A, AND SMALLEY, R E Bilateral adrenalectomy in malignant hypertension and diabetes J A M A, 144 439, 1950

111 THORN, G W, *et al* Clinical studies on bilateral complete adrenalectomy in patients with severe hypertensive vascular disease Ann Int Med, 37 972, 1952

112 WOLFERTH, C C *et al* Observations on the results of subtotal adrenalectomy in the treatment of severe otherwise intractable hypertension and their bearing on the mechanism by which hypertension is maintained Ann Int Med, 35 8, 1951

113 Adrenalectomy for severe hypertensive vascular disease Editorial J A M A, 154 914, 1954

114 JEFFERS, W A ZINTEL, H A, HILLS, A G, HAFKENSCHIEL J H LANGFELD S B, SELLERS, A M AND WOLFERTH C C Further observations on patients with severe hypertension subjected to adrenal resection and sympathectomy Ann Int Med 41 221, 1954

115 GARB S Personal communication

116 SCHROEDER, H A, AND GOLDMAN, M L Test for the presence of the 'hypertensive diencephalic syndrome' using histamine Am J Med, 6 162, 1949

117 LEE R E, AND HOLZE, E A Peripheral vascular hemodynamics in the bulbar conjunctiva of subjects with hypertensive vascular disease J Clin Investigation 30 539, 1951

118 GREISMAN, S The reactivity of the capillary bed of the nailfold to circulating epinephrine and norepinephrine in patients with normal blood pressure and with essential hypertension J Clin Investigation 31 782 1952

119 GOLDENBERG M, PINES, K L, BALDWIN E F GREENE, D G AND ROH C E The hemodynamic response of man to norepinephrine and epinephrine, and its relation to the problem of hypertension Am J Med, 5 792, 1948

120 KEZDI, P Sinoaortic regulatory system Role in pathogenesis of essential and malignant hypertension Arch Int Med 91 26 1953

121 PICKERING, G W Chairman s closing remarks *Ciba Fnd Sympos on Hypertension* p 280, Little, Brown and Co, Boston, 1954

122 CAMPBELL H E, AND BLANKENHORN M A The effect of sleep on normal and high blood pressure Am Ht J, 1 151 1925
123 HOOBLER S W AGREST, F A AND WARZINSKI R J Unpublished data
124 STOCK C C AND SCHROEDER H A Pressor substances in arterial hypertension activity and amine content of crude extracts of blood Am J Physiol 160 409 1950
125 SHORR E Hepatorenal factors in essential hypertension in man *Hypertension* pp 265-277, edited by L T BELL University of Minnesota Press, Minneapolis, 1951
126 BADEN H Is the responsiveness to epinephrine of the minute vessels in the rat cecal mesentary suitable for measuring vasodepressor and vasoexcitor material? Acta Physiol Scandinav 31 9 1954
127 GOLDBLATT H Experimental renal hypertension Am J Med 4 100 1948
128 DEXTER L AND HAYNES F W Relation of renin to human hypertension with particular reference to eclampsia pre-eclampsia and acute glomerulonephritis Proc Soc Exper Biol & Med 55 288 1944
129 GROLLMAN A Experimental studies on the pathogenesis and nature of hypertensive cardiovascular disease Ciba Fdn Symposium 12 122, 1954
130 KOLFF W J AND PAGE I H Blood pressure reducing function of the kidney reduction of reno-prival hypertension by kidney perfusion Am J Physiol 178 75 1954
131 SCHOTTSTAEDT W W GRACE W J AND WOLFF H G Life situations adaptive behavior patterns and renal excretion of fluid and electrolytes J A M A 157 1485 1955
132 GROLLMAN A AND SHAPIRO A P The volume of the extracellular fluid in experimental and human hypertension J Clin Investigation 32 312 1953
133 MASSON G M C PLAHL G CORCORAN A C, AND PAGE, I H Accelerated hypertensive vascular disease from saline and renin in nephrectomized dogs Arch Path 55 85 1953
134 MASSON G M C, DEL GRECO F CORCORAN, A C AND PAGE I H Acute diffuse vascular disease elicited by renin in rats pretreated with cortisone Arch Path, 56 23 1953
135 MASSON G M C, CORCORAN A C AND PAGE I H Renal and vascular lesions elicited by renin in rats with desoxycorticosterone hypertension Arch Path 53 217 1952

disease *Hypertension*, p 429, edited by E T BELL University of Minnesota Press, Minneapolis, 1951

109 PLATT, R, AND STANBURY, S W Sympathectomy in hyperten sion Lancet, 1 651, 1950

110 GREEN, D M, NELSON, J N, DODDS, G A, AND SMALLEY, R E Bilateral adrenalectomy in malignant hypertension and diabetes J A M A, 144 439, 1950

111 THORN, G W, *et al* Clinical studies on bilateral complete adrenal ectomy in patients with severe hypertensive vascular disease Ann Int Med, 37 972, 1952

112 WOLFERTH, C C, *et al* Observations on the results of subtotal adrenalectomy in the treatment of severe, otherwise intractable *hypertension and their bearing on the mechanism by which* hypertension is maintained Ann Int Med, 35 8, 1951

113 Adrenalectomy for severe hypertensive vascular disease Editorial J A M A, 154 914, 1954

114 JEFFERS, W A, ZINTEL, H A, HILLS, A G, HAFKENSCHIEL J H, LANGFELD, S B, SELLERS A M, AND WOLFERTH, C C Further observations on patients with severe hypertension subjected to adrenal resection and sympathectomy Ann Int Med, 41 221, 1954

115 GARB, S Personal communication

116 SCHROEDER, H A, AND GOLDMAN M L Test for the presence of the "*hypertensive diencephalic syndrome*" *using* histamine Am J Med, 6 162, 1949

117 LEE, R E, AND HOLZE, E A Peripheral vascular hemodynamics in the bulbar conjunctiva of subjects with hypertensive vascular disease J Clin Investigation, 30 539, 1951

118 GREISMAN, S The reactivity of the capillary bed of the nailfold to circulating epinephrine and norepinephrine in patients with normal blood pressure and with essential hypertension J Clin *Investigation*, 31 782, 1952

119 GOLDENBERG M PINES K L, BALDWIN E F, GREENE, D G AND ROH, C E The hemodynamic response of man to norepi nephrine and epinephrine, and its relation to the problem of hypertension Am J Med, 5 792, 1948

120 KEZDI P Sinoaortic regulatory system Role in pathogenesis of essential and malignant hypertension Arch Int Med, 91 26, 1953

121 PICKERING, G W Chairman's closing remarks *Ciba Fnd Sympos on Hypertension*, p 280, Little, Brown and Co Boston, 1954

148 FERRIS, E B BURST A A, AND DI SALVO R J Data to be published
149 BARRETT W B RUTLEDGE, R A AND ROGIE B Action of Serpasil on gastrointestinal motility and secretion Fed Proc 13 334 1954
150 JEFFERS W A ET AL Evaluation of adrenal resection and sympathectomy in 99 persons with hypertension J A M A 153 1502 1953
151 LENSHOEK C H, AND GROEN, J A case of malignant arterial hypertension treated by prefrontal lobotomy Rev Neur Paris 89 536 1953
152 FREEMAN W AND WATTS J W *Psychosurgery* 1st edition Charles C Thomas Springfield Illinois 1942
153 VON EULER U S Catechol amine excretion in urine in cases of hypertension *Ciba Fdn Sympos on Hypertension* p 200 Little Brown and Co Boston 1954
154 JIMÉNEZ DIAZ C DE LA BARREDA P AND DE MOLINA A F, Internal secretion of the arterial wall in blood pressure regulation p 58 *Ciba Fdn Sympos* Little Brown and Co Boston 1954
VON EULER U S Discussion p 72 *Ibid*
155 NELSON R A ET AL Comparison of the effects of pressor and depressor agents and influences on pulmonary and systemic pressures of normotensive and hypertensive subjects Am Ht J 50 172 1955
156 MOSCHCOWITZ ELI Hypertension its significance its relation to arteriosclerosis and nephritis and etiology Am J Med Sc 158 668 1919
157 Annotations Lancet 1 836 1953
158 HOOBLER S W Discussion *Hypertension* p 323 edited by E T Bell University of Minnesota Press Minneapolis 1951

136 PERERA, G A, AND BLOOD, D W Pressor activity of desoxycorticosterone acetate in normotensive and hypertensive subjects Ann Int Med, 27 401, 1947

137 THOMAS, C B, HOWARD, E, AND ISAACS, A The effect of sodium withdrawal upon the body weight of normal young men Bull Johns Hopkins Hosp, 85 115, 1949

THOMAS C B Heritage of Hypertension Am J Med Sc, 224 367, 1952

THOMAS C B Some observations on the relationship between weight change following sodium restriction and those associated with the menstrual cycle in normal young women Ann Int Med, 39 289, 1953

138 PERERA, G A *Hypertensive disease without hypertension Ciba Fdn Symposium, pp 46–50, 1954*

139 ELLIS, M E, AND GROLLMAN, A The antidiuretic hormone in the urine in experimental and clinical hypertension Endocrinology, 44 415, 1949

140 CHAPMAN, W P LIVINGSTON, R B, LIVINGSTON, K E AND SWEET W H Possible cortical areas involved in arterial hypertension Proc A. Res Nerv & Ment Dis *29 775 1950*

141 FERRIS, E B, REISER, H F BRUST, A A, AND HAGANS, J A Studies on natural history of hypertension To be published

142 TUNIS, M M, AND WOLFF, H G Studies on Headache Cranial artery vasoconstriction and muscle contraction headache A M A Arch of Neurol and Psych 71 425 1954

143 BARCROFT H, AND STARR I Comparison of the actions of adrenaline and noradrenaline on the cardiac output in man Clin Sc 10 295, 1951

144 REISER, M F AND FERRIS E B The nature of the cold pressor *test and its significance in relation to neurogenic and humoral* mechanisms J Cl Invest 27 156, 1948

145 HINES E A AND BROWN, G E Standard stimulus for measuring vasomotor reaction, its application to the study of hypertension Proc Staff Meeting, Mayo Clinic, 7 332 1932

146 MOSES L, DANIELS, G E AND NICKERSON, J I Psychogenic factors in essential hypertension, methodology and preliminary report Psychosom Med In Press

147 SIGLER, L H The role of hypertension in the etiology and prognosis of coronary occlusion Ann Int Med 42 369 1955

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